

SELECTED
WATER
RESOURCES
ABSTRACTS



VOLUME 6, NUMBER 18
SEPTEMBER 15, 1973

SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information are now provided by NTIS.

SELECTED WATER RESOURCES ABSTRACTS is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U.S. Department of the Interior, Washington, D. C. 20240.

SELECTED WATER RESOURCES ABSTRACTS is also available on subscription from the National Technical Information Service. Annual subscription is \$45 (domestic), \$56.25 (foreign). Certain documents abstracted in this journal can be purchased from the NTIS at prices indicated in the entry. Prepayment is required.



SPECIAL NOTICE - PRICE INCREASE

DEMAND ORDER FOR MICROFICHE

Because of the high cost of handling individual requests for microfiche, we have found it necessary to raise the price for this service. Effective August 16, 1973, the price for a report in microfiche will be raised from 95¢ to \$1.45 for domestic orders and from \$2.45 to \$2.95 for foreign orders, unless announced at a higher price. Microfiche announced at a price higher than \$1.45 will continue to be sold at the announced price. The \$1.50 added charge for foreign orders continues to apply. Deposit Account holders will be charged the increased price automatically. The price charged will be reflected on the monthly statement.

LIBRARY

ESTD 1910

UNIVERSITY OF TORONTO LIBRARIES
COMPANY

SELECTED WATER RESOURCES ABSTRACTS

**A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior**

The Selected Water Resources Abstracts is a semimonthly compilation of abstracts of publications dealing with water resources research. It is intended to provide a quick and convenient method of keeping up-to-date on the latest developments in the field of water resources research.

Abstracts are selected from a wide variety of sources, including scientific journals, technical reports, and other publications. The abstracts are intended to provide a quick and convenient method of keeping up-to-date on the latest developments in the field of water resources research. The abstracts are selected from a wide variety of sources, including scientific journals, technical reports, and other publications. The abstracts are intended to provide a quick and convenient method of keeping up-to-date on the latest developments in the field of water resources research.



**VOLUME 6, NUMBER 18
SEPTEMBER 15, 1973**

W73-11051 - W73-11700

The Secretary of the U. S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

REFUGED

WATER RESOURCES ABSTRACTS

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.



AT LEAST IN NAME
THEY ARE

—HAROLD H. RUSSELL

REFUGED

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by co-ordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

**Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240**

SELECTED WATER RESOURCES ABSTRACTS

CONTENTS

FOREWORD iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1A. Properties

THE THERMAL CONDUCTIVITY OF PURE WATER AND STANDARD SEA WATER AS A FUNCTION OF PRESSURE AND TEMPERATURE: PART II—PURE WATER,
Naval Ship Research and Development Center,
Bethesda, Md.
For primary bibliographic entry see Field 02K.
W73-11084

1B. Aqueous Solutions and Suspensions

A NEUTRON SPECTROSCOPIC STUDY OF THE DIFFUSIVE KINETICS AND INTERACTIONS OF WATER IN DENSE LAYER DESALINATION MEMBRANES,
Union Carbide Corp., Tuxedo, N.Y.
For primary bibliographic entry see Field 03A.
W73-11165

SALT AND NONELECTROLYTE INTERACTIONS IN WATER,
Pittsburgh Univ., Pa.

E. M. Arnett.

Available from the National Technical Information Service as PB-218 548, \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No. 836, October 1972, 60 p., 22 fig., 32 tab., 14-30-2570.

Descriptors: *Solute, *Enthalpy, *Entropy, Thermodynamics, Aqueous solutions, Salts.
Identifiers: *Nonelectrolytes, Salting-out, Nuclear magnetic resonance.

The interaction of nonelectrolytes with water and aqueous salt solutions has been investigated by several methods and several systems. Complete thermodynamics (ΔG , ΔH , ΔS) of salting-out and salting-in have been investigated for a number of nonelectrolytes in aqueous salt solutions. The results constitute the only such systematic study of salting enthalpies and entropies. Conversely, the interaction of sodium chloride and some other salts with water-glycerol acetate binaries has been probed by thermodynamics and ^{23}Na nmr. The relation of these results to interactions of cellulose acetate with salt water are considered. The behavior of the highly aqueous systems described here appears to be singular and is undoubtedly related to the unique ability of cool water to form extended three dimensional structured systems. (OSW)

W73-11166

02. WATER CYCLE

2A. General

PHYSICAL EROSION AND DENUDATION RATES IN CARTWRIGHT BASIN AND VICINITY, WILLIAMSON COUNTY, TENNESSEE,
Vanderbilt Univ., Nashville, Tenn. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W73-11140

HYDRAULICS OF SHALLOW FLOWS OVER STABLE ERODED SAND SURFACES DEFINED BY AREA SPECTRA,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
J. R. Burney, and L. F. Huggins.

Available from the National Technical Information Service as PB-221 347, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report No. 36, 1973, 129 p., 38 fig., 3 tab., 92 ref., 7 append. OWRR-B-016-IND(1).

Descriptors: *Overland flow, *Rainfall-runoff relationships, *Rainfall simulators, *Hydraulic models, *Retention, Discharge, Runoff, Slopes, Small watersheds, Flood flow, Topography, Hydraulic similitude.

Identifiers: Area spectra, Micro-relief.

Development, testing, and evaluation are reported of instrumentation for recording the physical configuration of a natural, fallow land surface which includes both grain and form effects, and an attempt to relate the information to the hydraulic response of the surface.
W73-11192

CHEMICAL CYCLES WITH ENERGY CIRCUIT MODELS,

Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.

H. T. Odum.

In: *The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971*, Göteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 223-259, 1972, 27 fig., 1 tab., 35 ref. AEC Contract AT-(40-1)-4150.

Descriptors: *Model studies, *Geochemistry, *Sea water, *Ecosystems, Water chemistry, Mathematical models, Analog models, Chemical reactions, Ecology, Environmental effects.

Identifiers: *Energy circuit models.

An understanding of the large and complex systems of cycles of the earth, the sea, and man requires the simplification that comes with making models. Among the modeling and modular languages being developed for synthesis of macrosystems, an energy language may be used to consider the chemical cycles that sustain the sea. The language is a formalization of concepts of energy flow in which pathways represent either the energy flow driven by single forces or those driven by populations of forces. Each driven flow has opposing forces of frictional, inertial, or static nature, the latter derived from downstream storage of potential energy. Since the pathways represent all energy flows, and since theorems of the language allow all flows of matter and information to have their energy values at their points of action in the system, a common denominator is provided for all parts of all kinds of systems. The energy circuit language may be helpful in organizing understanding and hypotheses about which flows are linear, which are multiplicative actions, which are important, and which receive outside forcing energies. By diagramming subsystems and subcycles, it is possible to focus on various ideas about the origin, stability, and changes in the sea as related to man and other changing patterns. (See also W73-11367) (Knapp-USGS)
W73-11381

MATHEMATICAL METHODS IN THE THEORY AND PRACTICE OF MOUNTAIN STREAMFLOW COMPUTATION AND FORECASTING (MATEMATICHESKIE METODY V TEORII I PRAKTIKE RASCHETOV I PROGNOZOV STOKA GORNYKH REK).
Sredneaziatskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Tashkent (USSR).

For primary bibliographic entry see Field 04A.
W73-11406

INFORMATION ON ACTIVITIES OF THE COMMISSION ON SURFACE WATERS OF THE

INTERNATIONAL ASSOCIATION OF SCIENTIFIC HYDROLOGY (IASH) (INFORMATSIYA O RABOTE KOMISII POVERKHNOSTNYKH VOD MEZHDUNARODNOY ASSOTSIAZII NAUCHNOY GIDROLOGII (MANG)),
N. V. Nikolskaya.

Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No 1, p 124-125, January-February 1973.

Descriptors: *Conferences, *Technical societies, Air pollution, Water pollution, Water quality control, Mathematical models, Water balance, Snow, Ice, Mountains.

Identifiers: *USSR, *International Association of Scientific Hydrology (IASH).

The 15th General Assembly of the International Union of Geodesy and Geophysics was held in Moscow, July 30-August 14, 1971. Of the approximately 40 symposia arranged, several were under the direction of the International Association of Scientific Hydrology (IASH), now known as the International Association of Hydrological Sciences. These symposia included: water and air pollution (including 15 papers devoted to water-quality control and 20 papers to groundwater contamination); mathematical models in geophysics (19 papers); snow and ice in mountainous areas (57 papers); and water balance in semiclosed bodies of water (9 papers). The program of IASH activities for 1971-75 included symposia on statistical methods in hydrology (United States, 1972); hydrology of lakes (Finland, 1973); solution of hydrologic problems in the absence of sufficient data (Spain, 1973); artificial recharge of groundwater (United States, 1973); problems of snow mechanics (Switzerland, 1973); water balance (France, 1974); influence of man on water balance and the hydrologic regime (France, 1974); interaction of surface waters and groundwater (France, 1974); mathematical modeling of water-resources systems (German Democratic Republic, 1975); and distribution of snow in connection with surface roughness (France, 1975). (Josephson-USGS)
W73-11414

HYDROLOGY OF TRUCKEE MEADOWS, NEVADA,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 04B.
W73-11430

WATERSHED RESEARCH,
Texas Tech Univ., Lubbock.
H. A. Wright, S. C. Bunting, D. Windham, E. T. Van Nieop, and F. M. Churchill.
Noxious Brush and Weed Control Research Highlights-1972, Vol 3, p 16-17, 1972, 2 photo. OWRR C-3191 (No 3699)(1).

Descriptors: *Water yield, *Sediment yield, *Small watersheds, *Burning, Soil erosion, Runoff, Demonstration watersheds, Slopes, Vegetation effects, Rainfall-runoff relationships.

Water yield, sedimentation, and water quality were measured following a burn and were related to various degrees of cover and slope. During the study, 12 watersheds were selected and fenced. Four of the watersheds were on level areas (2.7 to 3.7%), four were on moderate slopes (7.8 to 20.1%), and four were on steep slopes (37.3 to 60.6%). One watershed of each degree of slope was burned without any prepared firelines. The moderate slope produced more runoff than the control only after a very intense storm of 2.18 inches/hr. The steep watershed (slope 52.8%) that had been burned produced from 887 to 34,765 gal/acre for storms that ranged in intensity from 0.10 to 2.18 inches/hr. Burning did not cause a significant release of sediment on the level areas, and only the most intense storm caused sediment to move on the moderate slope. However, a slow in-

Field 02—WATER CYCLE

Group 2A—General

tensity storm, an intense storm, and a moderately intense storm all caused significant soil movement on the steep watershed that had been burned. Degree of slope appears to account for most of the variation between watersheds. Burning increases calcium two to eight times and doubles the amount of magnesium. Turbidity of water was unchanged on the level areas, slightly increased on the moderate slopes, and increased as high as 2.9 ppm on the burned steep slope compared to 1.0 on the steep control. (Knapp-USGS)
W73-11534

INVESTIGATION OF INFRARED ANOMALIES IN THE LAC DES DEUX MONTAGNES AREA, QUEBEC,
Department of the Environment, Ottawa (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 07B.
W73-11541

WATER RESOURCES INVENTORY OF CONNECTICUT: PART 6. UPPER HOUSATONIC RIVER BASIN,
Geological Survey, Hartford, Conn.
M. A. Cervone, Jr., D. L. Mazzafro, and R. L. Melvin.
Connecticut Water Resources Bulletin No 21, 1972. 84 p, 50 fig, 4 plate, 27 tab, 106 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Water quality, *Connecticut, Precipitation (Atmospheric), Streamflow, Runoff, Water wells, Aquifers, Water yield, Chemical analysis, Sediment transport, Hydrologic data, Basic data collections, Maps, Curves.
Identifiers: *Upper Housatonic River basin (Conn).

The upper Housatonic River basin report area in Connecticut has an abundant supply of water of generally good quality, which is derived from precipitation. Annual precipitation has averaged about 46 inches over a 30-year period. Of this, approximately 22 inches of water is returned to the atmosphere each year by evaporation and transpiration. For the 30-year period 1931 through 1960, the annual runoff from precipitation averaged 24 inches (294 billion gallons). During the same period, inflows from Massachusetts and New York have averaged 220 and 64 billion gallons per year, respectively. A total average annual runoff of 578 billion gallons is therefore available. Stratified-drift aquifers are the only ones generally capable of yielding more than 100 gpm to individual wells. Drilled, screened wells tapping this unit yield from 17 to 1,400 gpm, with a median yield of 200 gpm. About 37% of the wells sampled yielded water with more than 200 mg/liter dissolved solids, and 50% yielded water with more than 120 mg/liter hardness. The quantity of suspended sediment transported by streams under natural conditions is negligible. (Woodard-USGS)
W73-11555

CLIMATE CHANGE AND THE INFLUENCE OF MAN'S ACTIVITIES ON THE GLOBAL ENVIRONMENT,
National Center for Atmospheric Research, Boulder, Colo.
W. W. Kellogg.

Available from NTIS Springfield, Va., 22151 as PB-213 676, Price \$3.75 printed copy; \$0.95 microfiche. Paper presented at Symposium on Energy, Resources and the Environment, July 11, 1972, Kyoto, Japan: Mitre Corporation Document M72-166, September 1972. 23 p, 7 fig.

Descriptors: *Climatology, *Climates, *Weather modification, *Environment, Sea ice, Carbon dioxide, Weather, Temperature, Heat balance, Albedo, Irrigation.
Identifiers: *Climatic change.

The history of changes in the earth's climate are traced from the earliest times to the present as recorded in the rocks and ice caps. Man's potential impact on the climate is discussed including the impact of carbon dioxide, particulate matters, 'albedo' changes, irrigation, and the direct release of heat. The results of man's activities are uncertain at this moment, but some preliminary computer calculations indicate that man can influence the climate of the earth, and that the direction of this influence in the decade to come must be that of a warming essentially in the Northern Hemisphere. The Arctic Ocean pack ice represents an unstable part of the ocean-atmosphere system in that a warming that would remove the pack ice would produce a major one-way transition. The impacts of such a transition would be very grave for some regions of the earth, but cannot be spelled out to become a disaster for mankind. (Knapp-USGS)
W73-11562

ELECTRICAL-ANALOG MODEL STUDY OF A HYDROLOGIC SYSTEM IN SOUTHEAST FLORIDA,
Geological Survey, Tallahassee, Fla.
C. A. Appel.
Geological Survey Open-file report 73004, 1973. 51 p, 14 fig, 29 ref.

Descriptors: *Hydrologic systems, *Surface-groundwater relationships, *Aquifer characteristics, *Canals, *Analog models, *Florida, Hydrologic data, Correlation analysis, Aquifers, Water level fluctuations, Pumping, Groundwater recharge, Hydrogeology.

The hydrologic system of southeast Florida consists of the Biscayne aquifer, a system of levees and canals, and related water-control facilities. Because the canals cut into the highly permeable aquifer, the aquifer and canals form a hydraulically connected system. Thus, manipulation of water levels in a canal influences levels in the aquifer and conversely, pumping from the aquifer affects conditions in nearby canals. An electrical analog model of the hydrologic system was developed for estimating the transitory response of naturally occurring as well as man-induced stresses on the hydrologic system. Factors considered in constructing the analog model and analysis of results are described. A summary is presented of a model application to determine the quantity of water needed to maintain canals at specified stages in the southern part of Dade County during dry periods. The comparison between observed and model-derived responses to stress applied to the aquifer during the 1962 test period indicate that the analog model is feasible and useful in the analysis of problems. (Woodard-USGS)
W73-11570

2B. Precipitation

A CATALOG OF HYDROCLIMATOLOGICAL DATA FOR ALASKA'S COASTAL ZONE,
Alaska University, College Inst. of Water Resources.

R. F. Carlson, and G. Weller.
Available from the National Technical Information Service as PB-221 375, \$5.00 in paper copy, \$0.95 in microfiche. Alaska Institute of Water Resources Report No 25 (Sea Grant Report 72-2, May 1972. 56 p. OWRR A-999-ALAS (2).

Descriptors: *Hydrologic data, *Climatic data, *Coasts, *Alaska, *Publications, Information retrieval, Documentation, Bibliographies, Water resources development, Land development, Conservation, Ecology, Environment, Precipitation (Atmospheric), Ice, Snow.
Identifiers: Hydroclimatological catalog (Alaska coasts).

A complete understanding of Alaska's coastal water zone is important to resource development, conservation, and environmental concerns. This data catalog contains a listing of 192 hydroclimatological data sources of Alaska's coastal zone. Each source listing has three parts: an information citation, the nature of the data available, and the location for which all or part of the data is available. The information citation is comprised of six parts: the agency which compiled the data, the title of the source, the authors, the publication date of the source, the dates for which the data are applicable, and the library accession number of the source, which is the main University library, unless another is indicated. (Woodard-USGS)
W73-11056

SPECTRA OF TURBULENT FLUCTUATIONS OVER OCEAN WAVES,
Naval Postgraduate School, Monterey, Calif.
G. S. Bingham.

Available from NTIS, Springfield, Va 22151 as AD-73 624, Price \$3.00 printed copy; \$0.95 microfiche. M Sc Thesis, September 1972. 62 p, 24 fig, 22 ref.

Descriptors: *Weather forecasting, *Air-water interfaces, *Oceans, *Ocean waves, *Waves (Water), Turbulence, Winds, Analytical techniques, Spectroscopy.
Identifiers: Spectral analysis, Wind-wave coupling, BOMEX, Sea-air interaction.

Several applied problems, especially long range atmospheric prediction, have created considerable interest in the contributory effects of the near surface boundary layer over the oceans. Significant progress occurred in 1969 with respect to observational studies as a result of the Barbados Oceanographic and Meteorological Experiment (BOMEX). BOMEX took place in the Atlantic Ocean east-northeast of Barbados, West Indies. Spectral analyses were performed on turbulence data obtained over ocean waves during BOMEX. Results of seven selected periods were examined with respect to predictions in recent nonlinear and linear wind-wave coupling theories. Peaks in the velocity spectra occurred at the frequency of the wave spectra peaks (0.1 hz). At a frequency (0.26 hz) slightly higher than that of the wave spectrum peak the wind-wave phase relationship changes abruptly. This change occurred at a frequency where the wave phase speed was roughly two-thirds the mean wind speed at the level of measurement. At this same frequency the wind-wave correlation approached zero, and increased momentum transfer was observed. An examination of the amplitude ratio results confirmed the frequency of minimum wave induced disturbance to be at about 0.26 hz. (Woodard-USGS)
W73-11087

LARGE-SCALE AND LONG-TERM FLUCTUATIONS IN SOME ATMOSPHERIC AND OCEANIC VARIABLES,
National Weather Service, Silver Spring, Md. Extended Forecast Div.

J. Namias.
In: The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Göteborg, Sweden: Wiley Inter-science Division of John Wiley and Sons, Inc., p 27-48, 1972. 19 fig, 38 ref.

Descriptors: *Climatology, *Synoptic analysis, *Air-water interfaces, Weather, Climates, Ocean circulation, Air circulation, Air masses.
Identifiers: *Air-sea interactions.

Climatic fluctuations in the atmosphere of a month, season, or year are produced by circulation phenomena which, if persistent enough, may produce decadal, millennial, and longer climatic aberrations. Recent short-period climatic fluctuations differ only in degree and not in kind from

WATER CYCLE—Field 02

Snow, Ice, and Frost—Group 2C

great fluctuations of the past. Ocean variability is of a similar sort. When underlying sea-surface temperatures are studied in conjunction with these patterns, it is clear that the two media, air and sea, are coupled. The coupling takes place largely through heat exchange between sea and air and through water advection and mixing. For example, anomalous warm water temperatures in the cold months seem to encourage cyclone growth, while the cyclones frequently lessen evaporative heat losses by dampening the lower air with rain and by reducing back radiation through the formation of clouds. (See also W73-11367) (Knapp-USGS)
W73-11369

THE ROLE OF THE OCEANS AND BIOSPHERE IN THE CARBON DIOXIDE CYCLE,
National Oceanic and Atmospheric Administration,
Silver Spring, Md. Air Resources Labs.
For primary bibliographic entry see Field 02K.
W73-11373

THE INFERENCE OF ATMOSPHERIC OZONE USING SATELLITE NADIR MEASUREMENTS IN THE 1642/CM BAND,
National Aeronautics and Space Administration,
Langley Station, Va. Langley Research Center.
For primary bibliographic entry see Field 07B.
W73-11400

A MODEL FOR RAIN EROSION OF HOMOGENEOUS MATERIALS,
Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 08G.
W73-11560

HIGH-TEMPERATURE CONTACT NUCLEATION OF SUPERCOOLED WATER BY ORGANIC CHEMICALS AND APPENDIX OF COMPOUNDS TESTED,
Naval Weapons Center, China Lake, Calif. Michelson Labs.
For primary bibliographic entry see Field 03B.
W73-11699

2C. Snow, Ice, and Frost

A PRINCIPLES STUDY OF FACTORS AFFECTING THE HYDROLOGICAL BALANCE OF THE LEMON GLACIER SYSTEM AND ADJACENT SECTORS OF THE JUNEAU ICEFIELD, SOUTHEASTERN ALASKA, 1965-1969,
Michigan State Univ., East Lansing. Dept. of Geology.

M. M. Miller.

Available from the National Technical Information Service as PB-221 330, \$6.00 in paper copy, \$0.95 in microfiche. Completion Report Institute of Water Research, Michigan State University, Lansing, 1972. 294 p, 108 ref. OWRR B-002-MICH (4). 14-01-0001-1067.

Descriptors: *Glaciers, *Water balance, *Heat balance, Meteorological data, *Alaska.
Identifiers: Lemon Creek Glacier (Alas), Ptarmigan Glacier (Alas), Mass balance (Glaciers), Juneau icefields.

The purpose is to consider those factors permitting establishment of the relationship between glacier mass balance, water balance, and heat balance and to include an overall assessment of the controlling meteorological parameters. The main analyses concern observations as they pertain to long-term trends affecting the regime of the Lemon and Ptarmigan Glaciers in southeastern Alaska. Initially it was hoped that the measurements could be made in greater detail than in any previous glacier investigations in southeast Alaska. To some extent this aim has been accomplished. Certainly more

closely-spaced and more frequently checked observation sites were employed than in the study of the Lemon Glacier reported in 1964. Observations were also extended to include collection of data during periods of winter accumulation as well as in the summer ablation season. Considered in conjunction with a glacio-hydrological study on the Ptarmigan Glacier, and conducted in even more detail in the period 1966-1969, these data facilitate historical comparisons and add to the potential for forecasting future water budget trends. In a regional framework, this study provides information on a uniquely well-defined and completely self-contained glacier system ideally situated as a control location in the long-term glacio-climatic studies since 1946 on the Juneau Icefield, as well as for comparison with other coastal glacier systems originating in the complex of contiguous icefields in south and southeastern Alaska.
W73-11054

GREAT GLACIATIONS IN THE HISTORY OF THE EARTH (VELIKIYE OLEDENENIYA V ISTORII ZEMLI),
Akademiya Nauk SSSR, Moscow. Geologicheskii Institut.
B. M. Keller.
Sovetskaya Geologiya, No 9, p 26-35, September 1972. 1 fig, 54 ref.

Descriptors: *Glaciation, *Glaciers, *Glacial sediments, *Geologic time, Precambrian era, Paleozoic era, Quaternary period, Radioactive dating, Age.
Identifiers: USSR, *Geochronology, *Paleogeography, Tillites, Phanerozoic time, Riphean era, Ordovician period, Carboniferous period, Permian period.

Past great glaciations have been reliably established for Huronian deposits of the Canadian shield (tillites of the Gowganda formation dating back some 2 billion years in age), Upper Riphean deposits of Australia and South Africa, Wendian deposits of the Northern Hemisphere, Ordovician deposits of Africa, Upper Carboniferous and Lower Permian deposits of the Gondwana system, and anthropogenic (Quaternary) deposits. Great glaciations recur every 300 million years, and for the Phanerozoic generally coincide with the most important epochs of folding. The interval of time between two great glaciations corresponds to the duration of a cosmic year, this periodicity being particularly evident for the last two cosmic years.
(Josefson-USGS)
W73-11095

INFLOW TO RIVERS IN THE PAMIRS (PITANIYE REK PAMIROV),
Moscow State Univ. (USSR). Chair of Hydrology. S. Korinov.
Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No 5, p 110-113, September-October 1972. 2 fig, 2 tab, 7 ref.

Descriptors: *Inflow, *Rivers, *Mountains, *Streamflow, *Runoff, Groundwater, Melt water, Snowmelt, Glaciers, Rainfall, Air temperature, Watersheds (Basins), Elevation, Hydrograph analysis, Estimating.
Identifiers: *USSR (Pamirs).

Estimates are made of the groundwater, snowmelt, and glacier contribution to annual streamflow for 15 rivers in the Pamirs. The groundwater contribution to streamflow varies between 20% and 53%. Glacier and snowmelt components of runoff are 13%-57% and 12%-50% of the total streamflow, respectively. The proportion of total annual runoff which occurs as rainfall is 0% to 3%. Studies are made of relations of snowmelt and glacier components of runoff to basin elevation and of April-September runoff of the Lyangar River to air temperature. (Josefson-USGS)
W73-11096

RATE OF RETREAT OF YUZHNO-CHUYA GLACIERS IN THE GORNO-ALTAY AUTONOMOUS OBLAST (O SKOROSTI OTSTUPANII LEDNIKOV YUZHNO-CHUYSKIH BELKOV GORNOGO ALTAYA),
Moscow State Univ. (USSR). Kafedra Obshchei Fizicheskoi Geografii i Paleogeografii.

A. A. Svitoch, V. S. Khorev, and O. B. Parunin.
Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No 5, p 103-106, September-October 1972. 1 fig, 7 ref.

Descriptors: *Glaciers, Glaciation, Glacial drift, Radioactive dating, Age, Pleistocene epoch, Recent epoch.

Identifiers: *USSR (Gorno-Altay Autonomous Oblast), *Glacier retreat.

Radiocarbon dating of glacial formations in the Chegan-Uzun and Chegan River valleys (Gorno-Altay Autonomous Oblast) reveals that the age of glaciers range from 3,200 plus or minus 600 years to 25,300 plus or minus 600 years. The Sofiyevskiy glacier, measuring 7 km in length and located at absolute elevations of 2,600-2,615 m, is the largest of all glaciers in upper reaches of the Chegan River. In 1898-1939, the average rate of retreat of the glacier was 24 m/yr, and in 1939-62 it was 18.3 m/yr. In 1963-71, the rate of glacier recession dropped to 10 m/yr. Comparison of the average shrinkage rate in the Late Pleistocene (about 1 m/yr) and Holocene (about 2.4 m/yr) with that for the last 100 years (about 17 m/yr) suggests a continued rise in the glacier's rate of decline. (Josefson-USGS)
W73-11097

UPPER PERMIAN GLACIOMARINE DEPOSITS IN THE KOLYMA RIVER BASIN (VERKH-NEPERMSKIE LEDOVO-MORSKIE OTLOZHENIYA BASSEYNA ISTOKOV R. KOLYMY),
Severo-Vostochnoe Territorialnoe Geologicheskoe Upravlenie, Magadan (USSR).
For primary bibliographic entry see Field 02J.
W73-11103

SEASONAL EMERGENCE OF SOME HIGH ARCTIC CHIRONOMIDAE (DIPTERA),
Waterloo Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 02L.
W73-11148

THE GROWTH RATE OF ICE CRYSTALS: THE PROPERTIES OF CARBON DIOXIDE HYDRATE A REVIEW OF PROPERTIES OF 51 GAS HYDRATES,
Syracuse Univ., N.Y. Dept. of Chemical Engineering and Materials Science.
For primary bibliographic entry see Field 03A.
W73-11156

MOISTURE TRANSFER AND FROST HEAVE IN LOAMS,
For primary bibliographic entry see Field 02G.
W73-11193

LEAD CONTAMINATION OF SNOW,
Ministry of the Environment, Ottawa (Ontario). Water Management.
For primary bibliographic entry see Field 05B.
W73-11275

RESEARCH AND THE PROBLEMS OF TWO SEAS,
For primary bibliographic entry see Field 02L.
W73-11350

ICE FORCES ON VERTICAL PILES,
Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 06B.
W73-11538

Field 02—WATER CYCLE

Group 2C—Snow, Ice, and Frost

DRAININGS OF ICE-DAMMED SUMMIT LAKE, BRITISH COLUMBIA,
Department of the Environment, Ottawa (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 02E.
W73-11547

CONTINUOUS OBSERVATIONS OF THE STRUCTURAL CHANGES IN DEFORMING POLYCRYSTALLINE ICE,

Washington Univ., Seattle. Dept. of Atmospheric Sciences.

R. M. Sprenger.
Available from NTIS, Springfield, Va., 22151 as AD-755 336, Price \$3.00 printed copy; \$0.95 microfiche. Scientific Report, November 1972. 69 p, 17 fig, 1 tab, 25 ref, append. ONR Contract N00014-67-A-0103-0007.

Descriptors: *Ice, *Glaciology, *Cryobiology, *Crystallography, Investigations, Deformation, Temperature, Crystals, Ice cover, Stress, Melting, Mathematical studies, Photography, Analytical techniques.

Identifiers: *Ice deformation, Ice mechanics, Ice structure changes.

An apparatus was constructed to continuously observe structural changes accompanying the deformation of polycrystalline ice. Thin sections of natural glacier ice and arctic sea ice were subjected to compressive stresses of several bars at temperatures near the melting point. Polarized light was used to obtain photographic sequences of the deformation. The observations were designed so as not to interrupt the deformation, in contrast to previous studies. Grain boundary migration and basal glide were observed over a wide range of stresses and temperatures, while polygonization and various types of recrystallization were restricted to small stress-temperature regions. No voids or cracks were formed in the ice during these experiments. Regelation and intercrystalline sliding were not detected. Photographs and tracings of the deformation sequences and other quantitative data related to the observations are included. (Woodard-USGS)

W73-11556

TOWING ICEBERGS TO IRRIGATE ARID LANDS—MANNA OR MADNESS,
Cold Region Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 06F.
W73-11566

FORMATION AND FORECAST OF COMPONENTS IN THE HYDROLOGIC REGIMEN OF RIVERS (FORMIROVANIYE I PROGNOZY ELEMENTOV GIDROLOGICHESKOGO REZHIMA REK).

Ukrainian Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02E.
W73-11688

CHARACTERISTICS OF ICE-JAM FORMATION ON THE SOVIET REACH OF THE DANUBE (OSOBNOSTI ZATOVOORAZOVANIYA NA SOVETSKOM UCHASTKE DUNAYA),
Ukrainian Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).
N. F. Vagin, I. A. Kovernyay, and A. V. Shcherbak.
In: Formirovaniye i prognozy elementov gidrologicheskogo rezhima rek; Ukrainian Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut Trudy, No 112, p 57-68, Moscow, 1972. 4 fig, 2 tab, 12 ref.

Descriptors: *Ice, *Ice jams, *Rivers, Meteorology, Ice breakup, Water level fluctuations, Deltas, Winter, Forecasting.

Identifiers: *Danube River, Ice thickness.

The 171-km-long Soviet reach of the Danube between Remi and Vil'kovo was investigated for development of ice-jam forecasting techniques. The ice regime in lower reaches of the Danube is highly unstable. The probability of occurrence of ice phenomena is 82% and the probability of establishment of complete ice cover is 54% (1931-69). Depending upon hydrometeorological conditions in winter, the length of period between the first appearance of ice and its complete removal varies in individual years between 1 and 95 days. Ice formation and growth and decay of ice cover are accompanied by ice jams which occur at narrow river bends, islands, and channel constrictions. The thickness of ice jams is determined by a number of hydrometeorological factors including intensity of autumnal and winter cooling, severity of winter conditions, river discharges, intensity of spring processes (ice breakup), and presence of fast or floating ice. Specific examples are given of ice jams on the reach in winters of 1946-47, 1953-54, and 1966-67. (See also W73-11688) (Josefson-USGS)
W73-11694

FORECASTING TIME OF FORMATION OF COMPLETE ICE COVER IN THE UPPER DNEIPER BASIN (O PROGNOZIROVANII SROKOV NASTUPLENIYA LEDOSTAVA V BASSEYNE VERKHNEGO DNEPRA),

Ukrainian Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR). L. I. Solopenko.

In: Formirovaniye i prognozy elementov gidrologicheskogo rezhima rek; Ukrainian Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut Trudy, No 112, p 69-73, Moscow, 1972. 1 fig, 5 ref.

Descriptors: *Ice, *Ice cover, *Forecasting, Synoptic analysis, Air circulation, Autumn, Winter.

Identifiers: *Dnieper River.

Fall and winter ice phenomena on the Dnieper River at Rechitsa, Sozh River at Gol'me, and Deana River at Chernigov were investigated in 1938-67 for quantitative descriptions of macrosynoptic processes in the antecedent period of ice formation, and for influence of these processes on time of formation of complete ice cover in the Upper Dnieper basin. A graph shows the relation of the time of formation of complete ice cover at these locations to the index of macrosynoptic processes in August and September. This quantitative index can be used to forecast the time of formation of complete ice cover on these reaches by October 1, a month in advance of its earliest occurrence in the region. (See also W73-11688) (Josefson-USGS)
W73-11695

2D. Evaporation and Transpiration

COMPARISON OF SIMULATED AND ACTUAL EVAPORATION FROM MAIZE AND SOIL IN A LYSIMETER,

Connecticut Agricultural Experiment Station, New Haven, P. E. Waggoner, and N. C. Turner.

Agric Meteorol. Vol 10, No 1/2, p 113-123. 1972.
Identifiers: Diffusivity, *Evaporation, Humidity, Leaf, Lysimeter, *Maize-M, Net radiation, *Simulated evaporation, Simulators, Soils, Stomatal resistance, Temperature, Ventilation.

Evaporation from maize and soil in a pair of lysimeters in a maize crop, ventilation and net radiation above the crop canopy, temperature and leaf area and stomatal resistance in six strata of the canopy were observed during 12 1-hr periods. The measured evaporation was mimicked by an algebraic simulator of energy exchange in 6 canopy strata plus a 7th stratum occupied by bare stems

and the soil surface when the observed stomatal resistance or resistance that varied realistically with radiation was specified. If a constant stomatal resistance was specified, the simulation was inaccurate. Accurate simulation of evaporation from the soil required that diffusivity be decreased more rapidly within the lower canopy than the observed decrease in horizontal wind.—Copyright 1972, Biological Abstracts, Inc.
W73-11201

RADIATION, EVAPORATION AND THE MAINTENANCE OF TURBULENCE UNDER STABLE CONDITIONS IN THE LOWER ATMOSPHERE,

Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.

W. Brutsaert.

Boundary-Layer Meteorology, Vol 2, p 309-325, 1972. 51 ref. EPA 16130 DIP.

Descriptors: *Evaporation, *Heat transfer, *Air-water interfaces, Estimating equations, Mass transfer, Water cooling, Diffusion, Atmosphere.

Identifiers: *Turbulent diffusion.

An expression is derived relating the critical flux Richardson number with the critical (gradient) Richardson number. In contrast to an earlier analysis by Townsend (1958), which is restricted to the atmosphere well outside the earth's boundary layer, the present treatment is intended specifically for turbulent flow in the lower atmosphere and it takes account of the effect of evaporation on the stability. The effect of radiation on the rate of destruction of the mean square of the temperature fluctuations is obtained by considering the radiative flux divergence in a stratified atmosphere and by using a simple functional relationship to represent empirical emissivity data. Evaporation and radiation increase the critical Richardson number by a sensible amount depending on the atmospheric conditions, mainly temperature, humidity and the gradients. There is no definite critical Richardson number but rather a range between 0.25, below which turbulence is very likely, and somewhat higher than 0.5, above which turbulence is improbable. The value of the critical Richardson number can be expressed in terms of evaporation, radiation and the ratio ($\sigma_{\text{ma}} \text{ sub } w/u^*$) which also appears not to have a definite critical value. Evaporation and radiation cause the ratio ($\sigma_{\text{ma}} \text{ sub } w/u^*$) to be larger than unity under neutral conditions. These results, based on the assumption of Reynold's analogy, $KH \pm KM$, are consistent with the available experimental evidence. (EPA)
W73-11343

A POWER WIND LAW FOR TURBULENT TRANSFER COMPUTATIONS,

Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.

W. Brutsaert, and G-T Yeh.

Water Resources Research, Vol 6, No 5, p 1387-1391, October 1970. 2 tab, 40 ref. EPA 16130 DIP.

Descriptors: *Evaporation, *Heat transfer, *Air-water interfaces, Estimating equations, Mass transfer, Water cooling, *Winds.

Identifiers: *Turbulent diffusion.

The parameters C and m of a power law for the wind profile $u \pm Cu^* (z/z \text{ sub } o)^{1/m}$, where u^* is the friction velocity and z sub o is the roughness length of the surface, are determined as functions of the roughness and of the Monin-Obukhov stability length L through comparison with the log linear law for stable conditions and the interpolation law for unstable conditions. As expected, for neutral conditions the results show that m and C are approximately equal to 1/7 and 6, respectively. Parameter C increases slightly whereas m decreases with decreasing stability. (EPA)
W73-11344

WATER CYCLE—Field 02

Streamflow and Runoff—Group 2E

COMPUTING EVAPOTRANSPIRATION BY GEOSTROPHIC DRAG CONCEPT,
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
J. A. Mawdsley, and W. Brutsaert.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 99, No HY1, Proc Paper 9483 p 99-110, Jan 1973. 4 fig, 3 tab, 2 append. EPA 16130 DIP.

Descriptors: *Evaporation, *Heat transfer, *Air-water interfaces, Estimating equations, Mass transfer, Water cooling, Diffusion, Atmosphere.
Identifiers: *Turbulent diffusion.

A procedure for computing regional evapotranspiration has been derived and tested. The assumptions underlying the model are essentially those used in the one dimensional mass transfer methods, but the shear stress is determined by means of $(\tau_{\text{sub}} \text{a}) \pm \rho g (C \text{ sub } g)^2 (V \text{ sub } g)^2$ in which $\rho \pm$ the density of the air; $C \text{ sub } g \pm$ the geostrophic drag coefficient as first proposed by Lettau; and $V \text{ sub } g \pm$ the surface geostrophic wind. The main advantage of the method is that all data needed in the computation, i.e. the surface temperature, the pressure of the air, the specific humidity at two levels in the atmospheric boundary layer, and the surface geostrophic wind speed can be obtained from standard meteorological data. Generally, good agreement was obtained between mean monthly evapotranspiration computed for a number of stations and the corresponding evaporation data obtained from Class-A pans. (EPA)
W73-11345

UNIFIED FORMULATION OF WALL TURBULENCE,
Ebasco Services Inc., New York.
G-T Yeh.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY12, p 2263-2271, December 1972. 3 fig, 2 append. EPA 16130 DIP.

Descriptors: *Evaporation, *Heat transfer, *Air-water interfaces, Estimating equations, Mass transfer, Water cooling, Diffusion, *Turbulent flow.
Identifiers: *Turbulent diffusion.

By incorporating the effect of the viscosity into the roughness length model, allowing the total shear stress to vary linearly, and modifying the mixing length, the present theory gives good results for the entire flow region. The resulting equation covers the smooth wall as well as the rough wall flow. The equation also provides a single formula to describe the velocity profile in the three near-wall regions for a smooth surface. (EPA)
W73-11346

SENSITIVITY OF THE SOLUTION FOR HEAT FLUX OR EVAPORATION TO OFF-DIAGONAL TURBULENT DIFFUSIVITIES,
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
G-T Yeh, and W. Brutsaert.
Water Resources Research, Vol 7, No 3, p 734-735, June 1971. EPA 16130 DIP.

Descriptors: *Evaporation, *Heat transfer, *Air-water interfaces, Estimating equations, Mass transfer, Water cooling, Diffusion, Atmosphere.
Identifiers: *Turbulent diffusion.

The purpose is to study the effect of the terms containing the off-diagonal diffusivity components on the solution of the case of evaporation or turbulent heat transfer from a strip at ground level of width $2(x \text{ sub } o)$ extending laterally to infinity. It was concluded that the effect of the off-diagonal diffusivity may be considered negligible in the calculation of evaporation from large surfaces. (EPA)
W73-11347

PERTURBATION SOLUTION OF AN EQUATION OF ATMOSPHERIC TURBULENT DIFFUSION,

Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
G-T Yeh, and W. Brutsaert.
Journal of Geophysical Research, Vol 75, No 27, p 5173-5177, September 20, 1970. 1 fig, 6 ref. EPA 16130 DIP.

Descriptors: *Evaporation, *Heat transfer, *Air-water interfaces, Estimating equations, Mass transfer, Water cooling, Diffusion, Atmosphere.
Identifiers: *Turbulent diffusion.

The regular perturbation method with a small parameter is applied to solve a turbulent transfer equation in the lower atmosphere without the lateral effect. From this solution the effect of longitudinal diffusion on evaporation is shown to be negative but negligible for evaporating surfaces larger than, say, 100 cm in the direction of the wind. (EPA)
W73-11348

A SOLUTION FOR SIMULTANEOUS TURBULENT HEAT AND VAPOR TRANSFER BETWEEN A WATER SURFACE AND THE ATMOSPHERE,

Cornell Univ., Ithaca, N.Y., School of Civil and Environmental Engineering.
G. T. Yeh, and W. Brutsaert.
Boundary Layer Meteorology Vol 2, p 64-82, 1971. EPA 16130 DIP.

Descriptors: *Evaporation, *Heat transfer, *Air-water interfaces, Estimating equations, Mass transfer, Water cooling, Diffusion, Atmosphere.
Identifiers: *Turbulent diffusion, Water vapor transfer.

Interaction between sensible heat and water vapor diffusion in the lower atmosphere leads to the necessity of solving two simultaneous turbulent diffusion equations. This solution is obtained by the construction of Green's function which when incorporated in the boundary conditions produces two integral equations. These are solved by transformation into two algebraic equations by means of the Laplace Transformation. The results show how for a simple steady-state case, sensible heat and water vapor transfer and also the water surface temperature depend on the meteorological conditions and the rate of change of energy content of the water body. Due to advection, the water surface temperature and the turbulent fluxes vary in the downwind direction. However, for practical calculations of the mean evaporation or heat transfer, the error introduced by the use of an average temperature is usually quite small and negligible. (EPA)
W73-11349

2E. Streamflow and Runoff

COASTAL DYNAMICS ALONG MUSTANG ISLAND, TEXAS,

Western Michigan Univ., Kalamazoo.
For primary bibliographic entry see Field 02L.
W73-11081

VIRGINIA SMALL STREAMS PROGRAM, PRELIMINARY FLOOD-FREQUENCY RELATIONS,

Geological Survey, Richmond, Va.
E. M. Miller.

Open-file report, 1971. 28 p, 13 fig, 9 ref, 1 append.

Descriptors: *Floods, *Flood frequency, *Small watersheds, *Virginia, *Frequency analysis, Regression analysis, Hydrologic data, Equations, Analytical techniques, Correlation analysis, Frequency curves, Streamflow, Flood forecasting.

Techniques are presented for estimating the probable magnitude and frequency of floods on small streams in Virginia. Also included is the history and current status of the cooperative program of small stream flood frequency investigations in Virginia. Regression equations are based on records collected on streams that are virtually unaffected by the influences of urbanization. Therefore, the relations should not be used for estimating flood magnitudes and frequencies for streams with appreciable amounts of urbanization in their basins. Graphical techniques were used to define flood-frequency curves for small stream sites with the 5 to 10 years of available record. Also for the 1964-70 period, frequency curves were drawn for 20 long term record gaging stations in the Atlantic Slope basins and 14 long term record gaging stations in the Ohio River basins. Frequency curves using annual peaks for the total period of record were available for all the long term stations. The regression equations are applicable for estimating the 2, 5, and 10-year flood magnitudes at small stream sites in Virginia. (Woodard-USGS)
W73-11090

FINITE ELEMENT SOLUTION FOR GENERAL FLUID MOTION,

Alaska Univ., College, Inst. of Water Resources.
For primary bibliographic entry see Field 02B.
W73-11091

INFLOW TO RIVERS IN THE PAMIRS (PITANIYE REK PAMIRA),

Moscow State Univ. (USSR). Chair of Hydrology.
For primary bibliographic entry see Field 02C.
W73-11096

MINIMUM FLOW IN THE IBERIAN PENINSULA (MINIMAL'NYY STOK REK PIRENEYSKOGO POLUOSTROVA),

Moscow State Univ. (USSR). Chair of Hydrology.
K. S. Sivasami.
Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No 5, p 81-86, September-October 1972. 3 fig, 2 tab, 8 ref.

Descriptors: *Low flow, *Low flow frequency, *Average flow, Rivers, River basins, Drainage area, Water balance, Variability, Mass curves, Maps.
Identifiers: USSR, *Iberian Peninsula, Spain, Portugal.

Characteristics of minimum flow in the Iberian Peninsula were based on observations of runoff at 294 hydrologic stations located principally on unregulated river reaches in Spain. Twenty-six percent of the stations had a period of record of more than 30 years, 44% had a period of record of more than 20 years, and 30% had a period of record of less than 20 years. Seventy-three percent of the stations had a drainage area of less than 1,000 sq km, 21% had a drainage area between 1,000 and 5,000 sq km, and only 6% had a drainage area of more than 5,000 sq km. Average monthly minimum flow from the peninsula is 29.0 cu km, of which 19.84 cu km (68.4%) is flow into the Atlantic Ocean and 9.16 cu km (31.6%) is flow into the Mediterranean Sea. The average rate of minimum monthly flow for the entire peninsula is 1.60 liter/sec/sq km. For the Atlantic slope it is 1.57 liter/sec/sq km, and for the Mediterranean slope it is 1.6 liter/sec/sq km. The coefficients of variation of average monthly minimum flow vary widely. (Josephson-USGS)
W73-11098

DISTRIBUTION OF AVERAGE TURBIDITY OF RIVERS IN THE ARMENIAN SSR (RASPREDELENIYE SREDNEY MUTNOSTI REK PO TERRITORII ARMYANSKOY SSR),
Moscow State Univ. (USSR). Chair of Hydrology.
S. G. Musoyan.

Field 02—WATER CYCLE

Group 2E—Streamflow and Runoff

Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No 5, p 77-80, September-October 1972. 1 fig, 2 tab, 3 ref.

Descriptors: *Turbidity, Average, *Rivers, *River basins, Lake basins, Drainage area, Discharge (Water), Rocks, Maps.

Identifiers: *USSR (Armenian SSR).

Average turbidity of rivers in the Armenian SSR is based on data for 22 rivers in the Kura and Araks River basins, and Lake Sevan basin. Maximum average turbidity occurs in the Kura River basin (270 g/cu m) and minimum average turbidity, in the Lake Sevan basin (60 g/cu m). For rivers in the Araks basin, turbidity averages 188 g/cu m. The average turbidity of all rivers in the Republic is 173 g/cu m. A map shows the division of the Republic into 7 zones, where turbidity values range from less than 100 g/cu m to more than 600 g/cu m. (Josefson-USGS)

W73-11099

INVESTIGATION OF SEASONAL VARIABILITY OF RUNOFF ON RIVERS IN THE ALTAI AND SAYAN MOUNTAIN SYSTEMS (ISSLEDOVANIYE VNUTRIGODOVOY NERAVNOMERNOSTI STOKA REK ALTAYA I SAYAN), Moscow State Univ. (USSR). Chair of Hydrology. V. D. Bykov, A. N. Vazhnov, and I. S. Fedorova. Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No 5, p 23-31, September-October 1972. 3 fig, 2 tab, 5 ref.

Descriptors: *Runoff, *Rivers, *Mountains, *Variability, *Seasonal, Annual, Precipitation (Atmospheric), Floods, Melt water, Snowmelt, Glaciers, Elevation, River basins, Mass curves.

Identifiers: *USSR (Altay Mountains), *USSR (Sayan Mountains).

Changes in seasonal runoff with basin elevation and the relation of seasonal runoff to annual runoff were investigated for upper reaches of the Ob' and Yenisey Rivers and for reaches along the left bank of the Angara River. The relations obtained can be used to compute runoff characteristics for rivers in the Altay and Sayan mountain systems. (Josefson-USGS)

W73-11101

FLOOD OF JUNE 9-10, 1972, AT RAPID CITY, SOUTH DAKOTA, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C.

W73-11105

HYDROGRAPHIC STUDY OF THE SHELF AND SLOPE WATERS OF NEW YORK BIGHT, State Univ. of New York, Stony Brook. Marine Sciences Research Center.

M. J. Bowman, and P. K. Weyl.

Available from NTIS AD-748 012, Springfield, Va. 22151, Price \$3.00 printed copy; 95 cents microfiche. Technical Report Series No 16, August 1972. 46 p, 37 fig, 11 ref. ONR Contract No N00014-68-C-0298.

Descriptors: *Oceanography, *Atlantic Ocean, *Continental shelf, *Continental slope, New York, Water properties, Water temperature, Salinity, Ocean currents, Data collections, Sampling, Measurement, Boats, Hydrologic data, Ocean circulation.

Identifiers: *New York Bight, Gulf Stream, Temperature-salinity front.

Data are summarized from three oceanographic cruises made during 1970 and 1971 to investigate the physical characteristics of the shelf and slope waters of New York Bight. There was a sharp temperature-salinity front over the continental slope during the months of June 1970 and April 1971. Associated with this front was a subsurface warm

tongue delineated by a temperature maximum which intersected the edge of the shelf at a depth of about 150 meters. Data obtained in August 1971 showed no evidence of any temperature front over the slope but suggested the existence of an irregular salinity gradient. Three factors appear to be important in the dynamics of the formation and dispersion of the subsurface warm tongue over the continental slope. These are the existence of the temperature-salinity front and the associated convergence zone, the meanderings of the Gulf Stream and the creation of warm eddies, and the intrusion of Labrador water into the Bight. (Woodard-USGS)

W73-11110

DISAGGREGATION PROCESSES IN STOCHASTIC HYDROLOGY

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

R. D. Valencia, and J. C. Schaake, Jr.

Water Resources Research, Vol 9, No 3, p 580-585, June 1973. 11 ref.

Descriptors: *Hydrology, *Time series analysis, *Stochastic processes, Data collections, Seasonal, Streamflow, Runoff, Simulation analysis, Mathematical models, Systems analysis.

Identifiers: *Disaggregation processes, Covariance, Variance, Parameter estimation, Matalas' multivariate model, Autoregressive models, Functional noise approximation, Sequential data generation.

The need to preserve both long-term and short-term variance and covariance properties of hydrologic processes has led to the development of numerous stochastic models during the past few years. Among these are the models first proposed by Mandelbrot and Wallis for preserving the Hurst phenomenon. All these models use sequential generation schemes, and some require the process to be stationary without seasonal variations. A technique is presented for generating multiple hydrologic time series in which both the short-term and long-term variance and covariance properties, including seasonal variations, are preserved. The technique combines any of the presently used models for sequentially generating annual events with a disaggregation model for generating seasonal, monthly, weekly, or daily events within a year. The model presented herein does not necessarily generate data sequentially, although the autoregressive models of any order are special cases of this model. If an annual series has been generated by this or any other model, this model may be used to generate a parallel series of seasonal events from the given series of annual events. The model has been used for rainfall generation in Puerto Rico, streamflow generation in Argentina and the United States, and for generation of hourly water demands in the Boston water distribution system. (Bell-Cornell)

W73-11141

HYDRAULICS OF SHALLOW FLOWS OVER STABLE ERODED SAND SURFACES DEFINED BY AREA SPECTRA

Purdue Univ., Lafayette, Ind. Water Resources Research Center.

For primary bibliographic entry see Field 02A.

W73-11192

A STUDY OF THE FLINT RIVER, MICHIGAN, AS IT RELATES TO LOW-FLOW AUGMENTATION

Geological Survey, Lansing, Mich.

For primary bibliographic entry see Field 05G.

W73-11207

ANNUAL COMPILED AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES

IN THE FORT WORTH, TEXAS, METROPOLITAN AREA, 1971, Geological Survey, Fort Worth, Tex. For primary bibliographic entry see Field 04C.

W73-11215

PROBABILISTIC SHORT-TERM RIVER YIELD FORECASTS

Washington Univ., Seattle. Dept. of Civil Engineering.

For primary bibliographic entry see Field 04A.

W73-11366

PHYSICAL MODELS OF LARGE SCALE OCEAN CIRCULATION

Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.

G. Veronis.

In: The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley-Interscience Division of John Wiley and Sons, Inc., p 19-25, 1972. 2 fig, 3 ref.

Descriptors: *Ocean circulation, *Ocean currents, *Water chemistry, Oceanography, Winds, Tracers, Stratification, Thermal stratification, Topography.

Large scale ocean circulation is generated by wind stresses and by heat fluxes and salt fluxes (associated with evaporation and precipitation) at the surface. Flow below the wind-driven circulation is attributed to differences generated by differential solar insolation between equator and pole. The result is a poleward flow everywhere in the deep ocean. Boundary layer flow compensates for the unidirectional interior flow. This boundary current is on the western side of each basin. Western oceanic boundary regions (both abyssal and coastal) as well as regions of substantial topographic relief should be selected as sites for dense sampling. These regions are in contact with the deep water sources for most of the world's oceans and should provide the geochemist with the freshest concentrations of various tracers for each ocean. (See also W73-11367) (Knapp-USGS)

W73-11368

THE FRESHWATER STREAM, A COMPLEX ECOSYSTEM

Louisville Univ., Ky. Dept. of Biology.

For primary bibliographic entry see Field 06G.

W73-11389

WATER RECORDS OF THE U.S. VIRGIN ISLANDS, 1962-69

Geological Survey, Washington, D.C.

T. M. Robison.

Data report, 1973. 163 p, 4 fig, 2 ref.

Descriptors: *Streamflow, *Groundwater, *Water quality, *Virgin Islands, *Basic data collections, Water level fluctuations, Runoff, Gaging stations, Discharge measurement, Flow rates, Aquifers, Chemical analysis, Water analysis, Water chemistry, Water resources.

The surface water, quality of water, and groundwater records of the Virgin Islands from 1962 through 1969 are presented. The location of stations are shown on individual island maps. Each island map is followed by the tabulation of water records for that island. The records were collected by the Caribbean District of the Water Resources Division, U.S. Geological Survey, in financial cooperation with the Government of the Virgin Islands of the United States and the National Park Service. The base data collected at streamflow stations consist of records of stage and measurements of discharge. In addition, observations of factors affecting the stage-discharge relation, weather records, and other information are used to

WATER CYCLE—Field 02

Streamflow and Runoff—Group 2E

supplement base data. A descriptive statement is given for each quality-of-water data station, usually combined with the description for a streamflow station or observation-well station. This statement includes the location of the sampling station, drainage area, period of record, records available, and selected extremes. Ground-water level data were obtained from a network of observation wells located at significant places in important aquifers. A well description precedes each data table. Included are the type, geology and location of the well, the extremes of water level, and the period of record. (Woodard-USGS) W73-11396

EFFECTS OF URBANIZATION ON FLOODS IN THE HOUSTON, TEXAS, METROPOLITAN AREA,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 04C.
W73-11402

AN INVESTIGATION OF FLOODS IN HAWAII THROUGH SEPTEMBER 30, 1972,
Geological Survey, Honolulu, Hawaii. Water Resources Div.
R. H. Nakahara.
Basic Data Release—Progress Report No 15, March 1973. 207 p, 5 fig, 1 tab.

Descriptors: *Floods, *Peak discharge, *Streamflow, *Hawaii, *Basic data collections, Hydrologic data, Gaging stations, Stream gages, Crest-stage gages, Flood frequency, Flood damage, Flood control, Annual peak discharge, Reviews.

This progress report contains records of annual peak stage and discharge at gaging stations through September 30, 1972, and a compilation of peak discharges at miscellaneous sites. At the close of the water year, flood data were being collected from 64 regular gaging stations and 93 crest-stage gaging stations on Kauai, Oahu, Molokai, Maui, and Hawaii. Annual flood peaks were recorded somewhere in the state during each month of the year except May, September, and October. Also included are annual maximum discharges, by water years, for each station. Floods, mainly because of the high frequency of intense rainfall, are common in Hawaii. Flood damages to crops, homes, highways, and other facilities, and pollution of bays and estuaries from storm runoff and sediment discharge occur nearly every year. Knowledge of the magnitude and probable frequency of floods is necessary for the proper design of control and conveyance structures, pollution abatement facilities, and planning for use of flood plains. (Woodard-USGS) W73-11404

PROBLEM OF THE INFLUENCE OF SHAPE OF CHANNEL CROSS SECTION ON VELOCITY DISTRIBUTION IN A UNIFORM TURBULENT FLOW (K VOPROSU O VLIYANIYE FORMY SECHENIYA RUSLA NA RASPREDELENIYE SKOROSTI V RAVNOMERNOM TURBULENTNOM POTOKE),
Dnepropetrovski Khimiko-Tekhnologicheskii Institut, (USSR).
For primary bibliographic entry see Field 06B.
W73-11408

A MATHEMATICAL MODEL TO AID MANAGEMENT OF OUTFLOW FROM THE OKAVANGO SWAMP, BOTSWANA,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
For primary bibliographic entry see Field 06A.
W73-11543

DRAININGS OF ICE-DAMMED SUMMIT LAKE, BRITISH COLUMBIA, Department of the Environment, Ottawa (Ontario). Water Resources Branch.

R. Gilbert.
Canada Department of the Environment, Inland Waters Directorate Scientific Series No 20, 1972. 17 p, 8 fig, 14 ref, 3 append.

Descriptors: *Lakes, *Glaciers, *Dam failure, *Melting, Canada, Ice breakup, Leakage, Water balance, Water temperature.

Identifiers: *Ice-dammed lakes, *Summit Lake (B.C.).

Drainings of ice-dammed Summit Lake, B. C., occurred in 1961, 1965, 1967, 1968, and 1970. In 1968, tests were carried out on a water balance model for the lake equating inflow and precipitation to volume change in the filling lake, determination of overflow when full, and detection of water leakage under or through the ice dam. The water balance study indicated that if one half of the area of the damming glacier contributed inflow, a leak of 3 to 5 cu m per sec existed in August 1968, three months before the fourth draining. Lake water temperatures were recorded from July to September 1968 and in July 1969. Warmest water (2.6 deg C) was found farthest from the dam in early summer. Temperature decreased at all locations from mid-July. The existence of a small tunnel associated with a continuous leak, and enlarging of this tunnel by melt provides a rational explanation for the catastrophic drainings. Heat generated by potential energy loss during draining is sufficient to account for tunnel enlargement. For the drainings of 1965, 1967, 1968, and 1970, lake water temperatures of 0.2 deg C, 0.9 deg C, 0.15 deg C, and 1.1 deg C, respectively, were required to account completely for tunnel enlargement in the terminal stages. (Knapp-USGS) W73-11547

BIOLOGICAL EFFECTS OF FLUCTUATING WATER LEVELS IN THE SNAKE RIVER, GRAND TETON NATIONAL PARK, WYOMING,

Wyoming Univ., Laramie. Dept. of Zoology and Physiology.

R. L. Kroger.
The American Midland Naturalist, Vol 89, No 2, p 478-481, April 1973. 1 fig, 1 tab, 7 ref.

Descriptors: *Flow rates, *Water level fluctuations, *Irrigation effects, *Stoneflies, *Mayflies, *Caddisflies, *Diptera, *Mites, *Sculpins, Aquatic populations, Sampling, Invertebrates, Aquatic insects, Rivers, Benthic fauna, Wyoming, Freshwater fish, Water beetles, Midges.

Identifiers: *Snake River, Beetles, Macroinvertebrates, Alloperla, Isoperla, Ephemeralia inermis, Baetis tricaudatus, Paraleptophlebia, Rithrogena hageni, Hydropsyche, Hydropsyche, Glossosoma montana, Ocetis, Simulium, Atherix variagata, Metachela, Acarina, Chironomids.

Water levels fluctuate widely in the Snake River, Wyoming because of the demands for irrigation waters by Idaho potato growers. This study was conducted to determine whether these fluctuations had any significant effect on the biota in the river. Five samples of exposed streambed (0.092 sq m by 0.1 m deep) were collected after flow was reduced from 2.8 to 0.3 cu m per sec. in less than 5 minutes, and aquatic invertebrates separated. A total of 15,490 invertebrates weighing 13.6 g were identified. Dipterans, caddisflies, mayflies, and stoneflies, in that order, were most abundant. A drift net and a migration trap placed below the riffles before drawdown showed that all of the macroinvertebrates in the exposed areas were left stranded. It was estimated that in a 3-km stretch of the river over 3 billion invertebrates were destroyed. In addition, 35 sculpins were left stranded in three 0.84 sq meter areas. The results indicate that fluctuating water levels may be more

harmful to the production of sport fish than the actual destruction of prey organisms since algae and higher aquatic plants, which provide necessary habitat for these organisms, are also destroyed. Extreme low water levels may be more detrimental to productivity than fluctuating flows since other studies have shown that many organisms cannot adapt to alternating lotic and lentic habitats. It is concluded that flow conditions will have to be altered to improve the productivity of this area of the Snake River. (Little-Battelle) W73-11594

CITY OF ALBUQUERQUE SANDIA FOOTHILLS DRAINAGE.

O'Brien (Ken) and Associates, Albuquerque, N. Mex.

For primary bibliographic entry see Field 04A.
W73-11668

SUPPLEMENT TO CITY OF ALBUQUERQUE SANDIA FOOTHILLS DRAINAGE STUDY.

O'Brien (Ken) and Associates, Albuquerque, N. Mex.

For primary bibliographic entry see Field 04A.
W73-11669

STUDY FOR IMPROVEMENT OF MONTE SANO BAYOU FROM AIRLINE HIGHWAY TO MISSISSIPPI RIVER EAST BRANCH ROUGE PARISH, LOUISIANA.

Brown and Butler, Baton Rouge, La.
For primary bibliographic entry see Field 08A.
W73-11682

FORMATION AND FORECAST OF COMPONENTS IN THE HYDROLOGIC REGIMEN OF RIVERS (FORMIROVANIYE I PROGNOZY ELEMENTOV GIDROLOGICHESKOGO REZHIMA REK).

Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).

Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR). L. T. Pashova, editor, Moscow, 1972. 88 p.

Descriptors: *Rivers, *Regimes, *Forecasting, Flood routing, Floods, Channels, Reservoirs, Hydrographs, Streamflow, Runoff, Discharge (Water), Inflow, Water loss, Melt water, Snowmelt, Ice jams, Ice cover, Meteorological data, Digital computers, Optimization.

Identifiers: *Ukraine, Travel time, Nomograms.

Streamflow forecasting, flood-wave movement, and ice regime of rivers are investigated in this collection of 8 papers. Dynamics of snowmelt losses during a spring flood are described, and methods are developed for preparing a short-term forecast of spring-flood hydrographs based on channel inflow and for forecasting quarterly inflow of water to Dnieper River reservoirs during the cold period of the year. To compute travel time on tributary reaches of rivers and propagation of flood waves along the cascade of Dnieper River reservoirs, the M-220 digital computer was used. Formation of ice jams on the Soviet reach of the Danube is discussed together with the possibility of forecasting the time of formation of complete ice cover in the Upper Dnieper basin based on quantitative descriptions of macrosynoptic processes. (See W73-11689 thru W73-11695) (Josephson-USGS) W73-11688

PRECOMPUTATION OF A SPRING-FLOOD HYDROGRAPH BASED ON HYDROMETEOROLOGICAL DATA (PREDVYCHISLENIYE GIDROGRAFA VESENNEGO POLOVOD'YA PO GIDROMETEOROLOGICHESKIM DANNYM),
Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).

Field 02—WATER CYCLE

Group 2E—Streamflow and Runoff

Ye. I. Kochelaba.

In: Formirovaniye i prognozy elementov hidrologicheskogo rezhima rek; Ukrainskiy Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut Trudy, No 112, p 3-15, Moscow 1972. 3 fig, 4 tab, 20 ref.

Descriptors: *Flood forecasting, *Hydrographs, *Hydrograph analysis, *Meteorological data, Flood routing, Channels, Inflow, Discharge (Water), Runoff, Rainfall, Time lag, Snowmelt, Snow, Curves.

Identifiers: Travel time.

Short-term forecasts of snowmelt runoff were based on lag time curves for the Teteriv River at Makalevichi (drainage area—7,890 sq km; length—229 km), Uzh River at Poleskoye (drainage area—5,690 sq km; length—168 km), and Sozh River at Gomel' (drainage area—38,900 sq km; length—543 km). Channel inflow for the Uzh and Teteriv Rivers was calculated from average snowmelt intensity for the basin, while channel inflow for the Sozh River was calculated from snowmelt intensity in the zone of maximum discharge with allowance for regulation of runoff by snow cover and basin surface, dynamics of snowmelt losses, and rainfall during the snowmelt period. To determine beginning dates of snowmelt and to define parameters of lag time curves, the runoff of small basins was used. Channel inflow was calculated from data of a hydrometeorological network. (See also W73-11688) (Josefson-USGS)

W73-11689

INVESTIGATION OF THE DYNAMICS AND CALCULATION OF THE LOSSES OF SPRING RUNOFF IN A SMALL RIVER BASIN (ISSLEDOVANIYE DINAMIKI I RASCHET POTER' VESENNEGO STOKA V MALOM RECHNOM BASSEYNE),
Ukrainskiy Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut, Kiev (USSR).
V. A. Romanenko, and L. K. Grigor'yeva.
In: Formirovaniye i prognozy elementov hidrologicheskogo rezhima rek; Ukrainskiy Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut Trudy, No 112, p 16-26, Moscow, 1972. 2 fig, 13 ref.

Descriptors: *Water loss, *Snowmelt, *Runoff, *Spring, *Small watersheds, Snow, Snow cover, Water equivalent, Water yield, Precipitation (Atmospheric), Soil moisture, Snow surveys, Probabilities, Curves, Equations.

Identifiers: *Ukraine, Nomograms.

A method is proposed for calculating snowmelt losses during a flood by considering the dynamics of snowmelt losses in time and the regulating capacity of snow cover. Data used for computations in the 42-sq-km Golovyns'ya River basin include snowmelt intensity, precipitation, area of water yield, and snowmelt runoff conditions. Snowmelt was calculated from the temperature coefficient of melting and from the Shulyakovskiy nomogram, and water yield was determined at different values of the water-retaining capacity of snow. Runoff conditions were determined from the relation of soil moisture to depth of soil freezing. Methods are presented for defining curves of probability for the water equivalent of snow, and an evaluation is made of the computed snowmelt losses. (See also W73-11688) (Josefson-USGS)

W73-11690

EXPERIMENT IN THE USE OF DIGITAL COMPUTERS TO DETERMINE TRAVELTIME ON A TRIBUTARY REACH OF A RIVER (OPYT ISPOL'ZOVANIYA ETSVM PRI OPREDelenii VREMEN DOBEGANIYA NA PRITOCHNOM UCHASTKE REKI),
Ukrainskiy Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut, Kiev (USSR).
M. N. Sosedko.

In: Formirovaniye i prognozy elementov hidrologicheskogo rezhima rek; Ukrainskiy Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut Trudy, No 112, p 44-50, Moscow, 1972. 3 fig, 3 tab, 7 ref.

Descriptors: *Discharge (Water), *Tributaries, *Rivers, *Digital computers, Computer programs, Floods, Flood waves, Hydrographs, Gaging stations, Equations.

Identifiers: *Dnieper River, *Travel time.

The M-220 digital computer was used to compute traveltimes based on an equation of corresponding discharges on a reach of the Dnieper River between the Zhuravno and Galich gaging stations. A brief analysis is given of results of computation of traveltimes for discharges of different magnitudes. (See also W73-11688) (Josefson-USGS)

W73-11692

USE OF DIGITAL COMPUTERS TO COMPUTE PROPAGATION OF FLOOD WAVES ALONG THE CASCADE OF RESERVOIRS ON THE DNEPER RIVER (PRIMENENIYE ETSVM Dlya RASCHETA RASPROSTRANENIYA VOLN POLOVODIY PO KASKADU GIDROUZLOV NA DNEPRE),
Ukrainskiy Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut, Kiev (USSR).
L. B. Byshovets, and R. I. Margul's.

In: Formirovaniye i prognozy elementov hidrologicheskogo rezhima rek; Ukrainskiy Nauchno-Issledovatel'skiy Gidrometeorologicheskiy Institut Trudy, No 112, p 51-56, Moscow, 1972. 1 fig, 3 ref.

Descriptors: *Flood waves, *Flood routing, *Reservoirs, *Rivers, *Digital computers, Computer programs, Inflow, Discharge (Water), Water levels, Gaging stations, Equations.

Identifiers: *Ukraine, *Dnieper River.

The M-220 digital computer was used to compute propagation of flood waves along the cascade of reservoirs on the Dnieper River from upstream gaging stations (Mozyr' on the Pripyat' River, Rechitsa on the Dnieper River, Gomel' on the Sozh River, and Chernigov on the Desna River) to Kakhovka. The computer program consists of a subprogram of flood routing in river channels; a subprogram of flood routing in the reservoir; calculation of water inflow and outflow for the Kiev Reservoir; flood routing of the Desna River from Chernigov to the river mouth and of the Dnieper River from Kiev to Kanev; and calculation of inflow and outflow for the Kremenchug, Dnieper im. V.I. Lenina, and Kakhovka Reservoirs. The tabular printout provides data on inflow, water levels, and discharge of the Kiev Reservoir; water discharge at the mouth of the Desna near Kiev and Kanev; and inflow, water levels, and discharge of the Kremenchug, Dneprodzerzhinsk, Dnieper im. V.I. Lenina, and Kakhovka Reservoirs. (See also W73-11688) (Josefson-USGS)

W73-11693

2F. Groundwater

GROUND WATER RECHARGE THROUGH PITS AND WELLS,
Kansas Water Resources Research Inst., Manhattan.

For primary bibliographic entry see Field 04B.
W73-11053

GROUNDWATER DATA IN THE CORVALLIS-ALBANY AREA, CENTRAL WILLAMETTE VALLEY, OREGON,
Geological Survey, Portland, Ore.

For primary bibliographic entry see Field 04B.

W73-11053

GROUNDWATER REGIME IN THE ZONE OF INFLUENCE OF PUMPING (REZHIM GRUNTOVYKH VOD V ZONE VLIYANIYA VER-TIKAL'NOGO DRENAZHA),
Bukhanskaya Sel'skokhozyaistvennaya Opytnaya Stantsiya (USSR).

For primary bibliographic entry see Field 04B.

W73-11094

GROUND WATER IN FINNEY COUNTY, SOUTHWESTERN KANSAS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.

W73-11106

GROUNDWATER LEVELS IN NEBRASKA, 1972,
Geological Survey, Lincoln, Nebr.
For primary bibliographic entry see Field 04B.

W73-11120

BEHAVIOR OF GROUNDWATER FLOW SUBJECT TO TIME-VARYING RECHARGE,
Water Resources Engineers, Inc., Springfield, Va.
M. T. Tseng, and R. M. Ragan.
Water Resources Research, Vol 9, No 3, p 734-742, June 1973. 12 fig, 9 ref.

Descriptors: *Hydrologic systems, *Water resources development, *Groundwater movement, *Groundwater recharge, *Aquifers, *Methodology, Mathematical models, Systems analysis, Engineering, Planning, Streams.

The knowledge of dynamic response in a free surface groundwater flow system is of practical importance in many engineering applications. Problems such as drainage systems, earth dam designs, stream base flow estimate, and more recently groundwater pollution have been the major concerns of engineers and hydrologists. A numerical method is presented that is practical for application to the near field study or localized recharge for engineering feasibility and planning efforts. The dynamic response of two-dimensional unconfined aquifers subject to localized recharge is investigated. The variations of free surface profiles, discharges, and the flow patterns with respect to time in both fully penetrated and partially penetrated aquifer systems have been obtained by solving the governing partial differential equations numerically. The method treats the nonlinear free surface boundary as an initial condition, and the overall flow region has been solved as a boundary value problem at a given time. The numerical results agree with experimental data obtained from Hele-Shaw models. The method may be applied to study the quantitative and qualitative changes in groundwater reservoirs resulting from artificial or natural recharge. The method gives a point of departure for study of groundwater pollution. (Bell-Cornell)
W73-11142

COEFFICIENT OF PERMEABILITY OF HIGHLY PLASTIC CLAYS,
Kanazawa Univ. (Japan). Dept. of Engineering.
For primary bibliographic entry see Field 02G.

W73-11199

A SMALL DIMENSION PROBE FOR THE DETERMINATION OF GROUND WATER FLOW DIRECTION,
Technical Univ., Lodz (Poland).
T. Przedek, and S. Sztromaier.

In: Proceedings of the 4th Budapest Conference on Soil Mechanics and Foundation Engineering, A. Kezdi, editor, October 12-15, 1971, Hungary: Academias Kiado, Budapest, p 259-261, 1971. 1 fig, 5 ref.

Descriptors: *Groundwater movement, *Tracers, *Radioactivity techniques, *Instrumentation,

WATER CYCLE—Field 02

Groundwater—Group 2F

Tracking techniques, Radioisotopes, Adsorption, Water wells.

A method to determine groundwater flow in single wells is based on introducing an isotope solution into the borehole as an indicator and measuring the direction of the water movement with a probe. In the probe, detection of the indicator substance is indirect. It is absorbed by ion exchangers and then, after the removal of the probe, the amount of absorbed indicator is measured. The dimensions of the device allow its use in 150 mm holes. (Knapp-USGS)
W73-11200

STREAM DEPLETION FACTORS, ARKANSAS RIVER VALLEY, SOUTHEASTERN COLORADO: A BASIS FOR EVALUATING PLANS FOR CONJUNCTIVE USE OF GROUND AND SURFACE WATER,

Geological Survey, Lakewood, Colo.
For primary bibliographic entry see Field 04B.
W73-11221

ARTIFICIAL RECHARGE OF GROUND-WATER, A BIBLIOGRAPHY.

Office of Water Resources Research, Washington, D.C.
For primary bibliographic entry see Field 04B.
W73-11321

CALCITE SATURATION IN AN EASTERN KENTUCKY KARST STREAM.

Kentucky Univ., Lexington. Dept. of Geology.
For primary bibliographic entry see Field 02K.
W73-11391

GROUND-WATER BASIC DATA OF CAVALIER AND PEMBINA COUNTIES,

Geological Survey, Bismarck, N. Dak.
For primary bibliographic entry see Field 04B.
W73-11397

LOCATION AND DETERMINATION OF DEPTHS OF SUBSURFACE UNDULATIONS BY SEISMIC METHODS,

Kentucky Univ., Lexington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08E.
W73-11398

DISTRIBUTION AND COMPOSITION OF MINERAL WATER IN THE TUVA AUTONOMOUS REPUBLIC (ZAKONOMERNOSTI RASPROSTRANENIYA I SOSTAV PODZEMNYKH MINERAL'NYKH VOD TUVY),

Institut Zemnogo Kory, Irkutsk (USSR).
Ye. V. Pinneker, Yu. I. Kustov, and A. I. Krutikova.
Geologiya i Geofizika, No 11, p 68-78, November 1971. 1 fig, 2 tab, 9 ref.

Descriptors: *Water chemistry, *Water types, *Mineral water, Thermal water, Saline water, Acidic water, Thermal springs, Cold springs, Water temperature, Gases, Structural geology, Maps.

Identifiers: *USSR (Tuva ASSR), *Mineral springs, Mineralization, Radon, Balneology.

To construct a map of mineral water in East Siberia on a scale of 1:2,500,000 investigations were conducted in the Tuva ASSR in 1966-67. Mineral water in the Republic is divided into 8 types: (1) nitrogen thermal water; (2) carbonated thermal water; (3) carbonated nonthermal water (temperature < 20 deg C); (4) radon nonthermal water; (5) sodium-chloride saline water; (6) acidic water (pH < 5.5); (7) low-salinity, nonthermal water in a weak hydrogen-sulfide solution (H₂S > 0.01 g/liter); and (8) arsenic-bearing water. Five

hydromineral regions are identified: (1) the Eastern Sayan region of carbonated water and nitrogen thermal springs; (2) the Altay-Western Sayan region of nitrogen thermal springs; (3) the Khubsugul'skaya region of nitrogen thermal springs; (4) the Tuva region of mineral water of mixed composition; and (5) the Ubsuu-Nur region of chloride and sulfate waters and brines. Thermal and carbonated waters are associated with fractures and recent volcanism; radon waters are confined to granitoid intrusions; and saline water is developed within intermontane valleys. As a result of investigations, the number of known mineral springs in the Republic has increased from 22 to 34. (Knapp-USGS)
W73-11412

THE ENVIRONMENTAL TRITIUM CONCENTRATION OF UNDERGROUND WATER AND ITS HYDROLOGICAL INTERPRETATION,

Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Soils.

G. B. Allison, and J. W. Holmes.
Journal of Hydrology, Vol 19, No 2, p 131-143, June 1973. 5 fig, 3 tab, 23 ref.

Descriptors: *Tritium, *Groundwater movement, *Water balance, Recharge, Discharge (Water), Tracers, Mixing, Springs, Australia, Model studies.

Models which attempt to correlate the tritium concentration of water taken from aquifers to aquifer parameters are discussed. One model takes into account flow along individual streamlines and relates aquifer parameters to the observed tritium concentration at outflow. For the Gambier Plain unconfined aquifer in southern Australia, the calculated tritium concentration at outflow derived from known aquifer parameters is 0.7 T.U. The measured tritium concentration of several springs at outflow is also 0.7 T.U. Using the complete mixing model and the approximation that samples withdrawn from the aquifer on Eyre Peninsula, South Australia, are fully mixed, the mean annual recharge for the area is estimated at 3 cm/yr. (Knapp-USGS)
W73-11544

THE INFLUENCE OF DELAYED DRAINAGE ON DATA FROM PUMPING TESTS IN UNCONFINED AQUIFERS,

Sheffield Univ. (England). Dept. of Civil and Structural Engineering.

N. S. Boulton.
Journal of Hydrology, Vol 19, No 2, p 157-169, June 1973. 2 fig, 9 ref.

Descriptors: *Aquifer testing, *Drawdown, *Water yield, Aquitards, Permeability, Hydrogeology, Anisotropy, Equations.

Identifiers: Delayed yield.

Equations are given for the flow to a pumped well in an aquifer having uniform anisotropy and overlain by a low-permeability aquitard. The water table is assumed to be located in the aquitard. Drainage from the capillary zone above the water table is taken into account. The formation constants may be evaluated by using type curves. A well-known pumping test is reanalyzed, using the given equations. The time-drawdown curves can be explained only by the existence of a low-permeability stratum in the vicinity of the water table. In this example the slow drainage of the unsaturated zone above the water table seems to be a significant factor in determining the shape of the time-drawdown curves. (Knapp-USGS)
W73-11545

AVAILABILITY OF GROUNDWATER FOR PUBLIC-WATER SUPPLY IN CENTRAL AND

SOUTHERN ESCAMBIA COUNTY, FLORIDA: INTERIM REPORT, JULY 1972,

Geological Survey, Tallahassee, Fla.
H. Trapp, Jr.
Geological Survey open-file report 72029, 1973, 100 p, 5 fig, 14 ref, 1 append.

Descriptors: *Groundwater resources, *Water wells, *Aquitards, *Water quality, *Florida, Well data, Aquifer characteristics, Water yield, Groundwater recharge, Water utilization, Water supply, Water resources development, Chemical analysis, Hydrologic data, Data collections, Water levels, Test wells, Drillers logs.

Identifiers: *Escambia County (Fla), *Pensacola (Fla).

Earlier hydrologic studies show that ample quantities of soft water of low dissolved solids content are obtainable from the sand-and-gravel aquifer in central and southern Escambia County, Fla. Some wells drilled for the city of Pensacola have yielded water with unacceptable high amounts of iron and carbon dioxide, and some wells have had low yields. The city, therefore, is seeking hydrologic information, including water-quality data, in an effort to avoid the high cost of well abandonment and to plan for future expansion of the water-supply system. The project area extends from the western end of Santa Rosa Island, through Pensacola to State Road 196 north of Quintette. The investigation included the collection of well data, chemical analyses of water samples, test drilling, radioactivity logging of test holes and other wells, and water-level measurements. Quality-of-water maps have been updated from the first year's report (See W72-09267), and graphic logs of the test holes drilled during the second year of the project are presented. (Woodard-USGS)
W73-11563

ARTIFICIAL RECHARGE IN THE WHITE-WATER RIVER AREA, PALM SPRINGS, CALIFORNIA,

Geological Survey, Menlo Park, Calif. Water Resources Div.

For primary bibliographic entry see Field 04B.

W73-11565

GROUND-WATER QUALITY IN WISCONSIN THROUGH 1972,

Geological Survey, Madison, Wis.
C. L. R. Holt, Jr., and E. L. Skinner.
Wisconsin Geological and Natural History Survey Information Circular No 22, 1973. 148 p, 6 fig, 2 tab, 46 ref.

Descriptors: *Hydrogeology, *Groundwater movement, *Groundwater resources, *Water quality, *Wisconsin, Hydrologic data, Reviews, Evaluation, Water yield, Water analysis, Chemical analysis, Geochemistry, Dissolved solids, Aquifers, Water wells, Erosion rates.

Available information on the quality of groundwater in Wisconsin is summarized. Major sources for this information are more than 30 technical reports that describe groundwater resources and quality in river basins, counties, and special study areas. A background of chemical-quality data is presented on groundwater as it occurs in natural and man-modified environments. These data constitute a base for planning and managing the water and land resources of Wisconsin. The water quality monitoring program for groundwater is described. In Wisconsin, the average dissolved-solids content of groundwater discharged to lakes and streams and from wells is about 200 mg/liter; groundwater discharge is estimated to be 16 billion gallons per day; about 87 tons per square mile of mineral matter is being dissolved annually from soil and rocks. (Woodard-USGS)
W73-11568

Field 02—WATER CYCLE

Group 2F—Groundwater

ELECTRICAL-ANALOG MODEL STUDY OF A HYDROLOGIC SYSTEM IN SOUTHEAST FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 02A.
W73-11570

2G. Water in Soils

A NEW METHOD FOR THE SOIL MOISTURE MEASUREMENT (MOMIN'S METHOD), J. Kubo.

Available from NTIS, Springfield, Va 22151 as N-72 28349, Price \$3.00 printed copy; \$0.95 microfiche. National Aeronautics and Space Administration Technical Translation TT F-14394, July 1972, 8 p, 3 fig, 4 ref. (Translation of 'Shin Dojo Subun Sokuteiho (Momin Ho No Jisshi)', Agricultural Meteorology (Japan), Vol 8, p 108-110, 1953).

Descriptors: *Soil moisture meters, *Soil moisture, Measurement, Thermal conductivity, Instrumentation, Methodology, Soil temperature, Correlation analysis, Thermometer.

Identifiers: Metallic plate.

A new method for soil moisture measurement which utilizes thermal conductivity is presented. In the traditional method of utilizing the thermal conductivity, a metallic plate buried in the soil is heated electrically and its temperature measured, but this method is quite troublesome. In the experiment, the latter half of the bulb of a mercury thermometer was wound with a heating wire. This heating part was electrically and thermally insulated from the soil. The bulb was heated by a constant electric current, and the time was measured in seconds for the temperature to rise by 5 deg C. The principle of this method is that within the bulb, the half on which the heating wire is wound gains heat, while the other half, which is in contact with the soil, loses heat in a certain proportion due to the thermal conductivity of the soil. When the variation in the soil temperature is large, the linear relationship must be determined for at least 2 to 3 kinds of temperature range. Furthermore, if the contact between the tip of the bulb and the soil is not perfect, an unexpected error may be created; it also becomes necessary to obtain a linear relationship for each soil where the apparatus is installed. (Woodard-USGS)

W73-11117

ANALYSIS OF SOIL TEMPERATURES IN THE ARID ZONE OF INDIA BY FOURIER TECHNIQUES,

Central Arid Zone Research Inst., Jodhpur (India). A. Krishna and R. S. Kushwaha. Agric Meteorol. Vol 10 No 1/2, p 55-64, 1972. Illus. Identifiers: *Arid lands, Fourier analysis, Harmonics, *India, Infiltration, Mass, Moisture, Monsoons, Rainfall, *Soil temperature.

Harmonic analyses of weekly means of soil temperatures were made at Jodhpur, India with sandy to loamy sand soil (clay content 6-8%). The amplitudes and phase angles corresponding to various depths in respect of different harmonics are presented. The amplitudes for various depths vary between 4.8 deg C and 9.1 deg C for first harmonic and decrease sharply with higher order harmonics. The values for 4th harmonic are 0.12-0.64 deg C only. The warmest soil near the soil surface occurs on June 28 while at 120 cm depth, the highest temperature maximum occurs on July 29, a delay of 1 mo. The 2nd and 3rd harmonics represent 8-22 and 0.6-4% of total variance, respectively. This effect of monsoon period on soil temperature profile at Jodhpur is due to infiltration of rainfall. The change in soil temperature pattern after July due to occurrence of the southwest monsoon is well reflected, if the 3rd harmonic is superimposed on the sum of the 1st 2 harmonics. The thermal dif-

fusivity computed from amplitude variation and from phase displacement do not agree showing the non-applicability of the theory of heat conduction in a semi-infinity homogeneous medium for Jodhpur soil. The mass movement of moisture during the monsoon and flow of moisture in the vapor phase probably invalidate the application of this simple theory.—Copyright 1972, Biological Abstracts, Inc.

W73-11177

MOISTURE TRANSFER AND FROST HEAVE IN LOAMS,

B. I. Dalmatov, V. D. Karlov, and V. M. Sokolova. In: Proceedings of the 4th Budapest Conference on Soil Mechanics and Foundation Engineering, A. Kezdi, editor, October 12-15, 1971, Hungary: Akademiai Kiado, Budapest, p 53-59, 1971. 4 fig, 2 tab, 6 ref.

Descriptors: *Frost action, *Moisture content, *Soil water movement, *Frost heaving, Heat transfer, Freezing, Thawing, Unsaturated flow, Soil mechanics.

The moisture transfer process in loam depends on density and moisture content. Analysis for this process was based on the methods of heat transfer theory. Moisture transfer potential fully characterizes the moisture migration intensity, and the migration depends basically on moisture gradient. The experimentally established relationship between moisture transfer potential and initial moisture volume of loam has a linear character. Experiments on frost heave were carried out with loam samples having different densities and consistencies. A linear relationship between frost heave and initial moisture content was established. Testing of unsaturated samples showed the influence of volume increase in water on frost heave, the formation of new pores and microfissures, and shrinkage. (Knapp-USGS)

W73-11193

BEHAVIOUR OF FINE SANDS AND SILTS DURING THE RISE OF GROUND-WATER LEVEL,

Ceskoslovenska Akademie Ved, Prague. Ustav Teoretické a Aplikované Mechaniky. J. Havlicek.

In: Proceedings of the 4th Budapest Conference on Soil Mechanics and Foundation Engineering, A. Kezdi, editor, October 12-15, 1971, Hungary: Akademiai Kiado, Budapest, p 121-126, 1971. 3 fig, 4 ref.

Descriptors: *Soil mechanics, *Foundations, *Saturation, *Silts, *Bearing strength, Water level fluctuations, Water table, Sands, Infiltration, Soil strength, Soil engineering. Soil physical properties, Soil structure, Soil water, Soil moisture.

Identifiers: *Soil liquefaction.

Saturation of some dry silty soils leads to their liquefaction. This phenomenon is particularly important for countries where the summers are very hot and dry, the winters rainy, and where the subsoil is silty. In the calculation of the bearing capacity of silty soils, decrease of safe foundation depth must be taken into account. (Knapp-USGS)

W73-11194

PORE PRESSURE MEASUREMENTS IN AELOTROPIC PEAT,

Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Civil Engineering. K. V. Helenelund.

In: Proceedings of the 4th Budapest Conference on Soil Mechanics and Foundation Engineering, A. Kezdi, editor, October 12-15, 1971, Hungary: Akademiai Kiado, Budapest, p 127-134, 1971. 6 fig, 9 ref.

Descriptors: *Peat, *Pore pressure, *Anisotropy, *Soil physical properties, *Soil tests, Soil strength, Consolidation, Shear, Soil mechanics.

Identifiers: *Aerotrophic peat.

Pore pressures in fibrous peat show great variations in the pore water pressure depending on the direction of the applied stress. High pore water pressures are observed in vertical tests with the major principal stress perpendicular to the horizontal fiber plane of the peat. Considerably smaller pore water pressures are observed in horizontal tests, with the major principal stress acting parallel to the fiber plane. Due to the tensile strength of the fibers, the lateral displacements in vertical unconfined compression tests are small, and the dilatation is compensated by high pore water pressures. In horizontal tests the lateral tensile strength perpendicular to the fiber plane is small, the cross section of the sample increases, and the pore water pressure decreases. In this case a part of the load is carried by an effective fiber stress in an early stage of the test. The increase in pore water pressure is small until the angle between the fiber plane and the major principal stress exceeds 30 deg, and a considerable increase in the pore water pressure is observed when this angle exceeds 60 deg. (Knapp-USGS)

W73-11195

RELATIONSHIPS BETWEEN VOLUME AND PORE-WATER CHANGE AND SHEAR STRESS IN GRANULAR SOILS,

Ceskoslovenska Akademie Ved, Prague. Ustav Teoretické a Aplikované Mechaniky. B. Kamenov.

In: Proceedings of the 4th Budapest Conference on Soil Mechanics and Foundation Engineering, A. Kezdi, editor, October 12-15, 1971, Hungary: Akademiai Kiado, Budapest, p 143-154, 1971. 6 fig, 11 ref.

Descriptors: *Soil mechanics, *Soil tests, *Sands, *Pore water, Stress, Strain, Shear, Compressive strength, Soil strength, Pore pressure, Density, Porosity.

Shear box and triaxial tests were made on Zbraslav sand. The shear box tests used constant and variable sample height, and both drained and undrained triaxial tests were made with initial pore-water pressure and with different cell pressures and initial densities. The influence of volume strain and pore-water pressure gradients on the shearing resistance was studied. The relations were linear and influenced by the loading path and stress level, by the geometrical arrangement of the structural system in question, and by the kinematic conditions of the deformation process. A method to find the residual shearing resistance based on the zero gradient of volume strain and pore-water pressure in triaxial tests is proposed. The residual resistance of granular soils was independent of the loading path. It is affected by the nature of the tested material and, if crushing of grains could take place, by the stress level in the failure plane. (Knapp-USGS)

W73-11197

BEHAVIOR OF TRANSITION SOILS UNDER THE EFFECT OF WATER,

Technical Univ. of Budapest (Hungary).

A. Kezdi, L. Marczal, E. Biczok, and I. Kabai.

In: Proceedings of the 4th Budapest Conference on Soil Mechanics and Foundation Engineering, A. Kezdi, editor, October 12-15, 1971, Hungary: Akademiai Kiado, Budapest, p 165-176, 1971. 12 fig, 1 tab, 4 ref.

Descriptors: *Soil mechanics, *Soil moisture, *Soil strength, Soil structure, Loess, Silts, Sands, Clays, Bearing strength, Water levels, Saturation, Infiltration, Permeability, Hydraulic conductivity, Soil physical properties.

Identifiers: Soil liquefaction.

WATER CYCLE—Field 02

Water in Soils—Group 2G

In Hungary most of the land surface is covered with transition soils between sand and clay. These soils include silts and silty fine sands. In the transition soils severe erosion occurs under the effect of surface water movement. When the soils are saturated, the weak cohesion rapidly disappears and the soil disintegrates; under the effect of inundation the loaded soil collapses. The phenomena taking place at the surface of grains are predominantly physical processes involving the interaction of water and surfaces of rough grains. The bond between the grains is weak, and the strength responds quickly and very sensitively to the change in water content. In the transition soils the pores are commonly large enough to allow a relatively free movement of water. Under the effect of dynamic load, these soils behave very elastically. (Knapp-USGS)
W73-11198

COEFFICIENT OF PERMEABILITY OF HIGHLY PLASTIC CLAYS, OF Kanazawa Univ. (Japan). Dept. of Engineering.

Y. Nishida, H. Koike, and S. Nakagawa.
In: Proceedings of the 4th Budapest Conference on Soil Mechanics and Foundation Engineering, A. Kezdi, editor, October 12-15, 1971, Hungary: Academiai Kiado, Budapest, p 219-224, 1971. 5 fig, 5 ref.

Descriptors: *Permeability, *Clays, *Clay minerals, *Void ratio, Consolidation, Adsorption, Compaction, Soil physical properties, Expansive clays, Soil water movement.

From theoretical calculation of the water flow in the pore space of clays where the individual particles are surrounded by absorbed water layers, a relationship was established between the coefficient of permeability and the void ratio. By extending the use of the Hazen-Poiseuille equation to highly plastic clays, the coefficient of permeability was found to be proportional to the 5th power of the void ratio. (Knapp-USGS)
W73-11199

EFFECT OF SOIL, COVER, SLOPE, AND RAINFALL FACTORS ON SOIL AND PHOSPHORUS MOVEMENT UNDER SIMULATED RAINFALL CONDITIONS,

Ohio State Univ., Columbus. Dept. of Agronomy.
For primary bibliographic entry see Field 05B.

W73-11208

USE OF PHYSICAL METHODS TO EXPAND SOIL SURVEY INTERPRETATIONS OF SOIL DRAINAGE CONDITIONS,

Wisconsin Univ., Madison. Dept. of Soil Science.
J. Bouma.

Soil Science Society of America Proceedings, Vol 37, No 3, p 413-421, May-June 1973. 9 fig, 36 ref.

Descriptors: *Hydraulic conductivity, *Model studies, *Soil water movement, Numerical analysis, Hydraulic models, Permeability, Soil physical properties, Soil surveys, Soil physics.

Complex numerical procedures and simple approximate physical methods, both requiring hydraulic conductivity and moisture retention data, can be used to calculate hydrodynamic soil behavior for a variety of simplified boundary conditions. Two approximate methods were applied to four Wisconsin soils in which measurements of hydraulic conductivity had been made in situ. Two soils that had been placed previously in different drainage classes on the basis of differences in soil mottling, actually had comparable hydrologic properties. Soil survey methods do not provide the quantitative data needed for predicting what soil behavior will be under environmental conditions that have changed temporarily or permanently. (Knapp-USGS)
W73-11210

RELATIONSHIPS BETWEEN SATURATED HYDRAULIC CONDUCTIVITY AND MORPHOMETRIC DATA OF AN ARGILLIC HORIZON,

Wisconsin Geological and Natural History Survey, Madison.

J. L. Anderson, and J. Bouma.
Soil Science Society of America Proceedings, Vol 37, No 3, p 408-413, May-June 1973. 3 fig, 2 tab, 14 ref.

Descriptors: *Hydraulic conductivity, *Saturated flow, *Soil water movement, Tracers, Sampling, Pores, Permeameters, Cores, Equations.

Identifiers: *Soil morphology, *Pore geometry.

A method of calculating saturated hydraulic conductivity in soil on the basis of morphometric data yielded reproducible results for seven soil peels sampled in the argillitic horizon of a Batavia silt loam. Calculated values were reasonably close to those measured in situ with the double tube method. The method was also successfully applied to impregnated horizontal sections through soil cores. Dye studies demonstrated the validity of some of the underlying assumptions of the method, which predicts a strong relationship between core height and measured hydraulic conductivity. Experiments confirmed this relationship and a representative core size was defined for the studied horizon using the morphometric data. (Knapp-USGS)
W73-11211

STEADY-STATE SEEPAGE IN A HILLSIDE,

Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.

G. C. A. Morin, and A. W. Warrick.
Soil Science Society of America Proceedings, Vol 37, No 3, p 346-351, May-June 1973. 4 fig, 2 tab, 11 ref.

Descriptors: *Seepage, *Soil water movement, *Equations, *Slopes, Mathematical studies, Flow nets, Overland flow, Infiltration, Soil erosion.

Two-dimensional seepage of water from a hillside adjoining a flat horizontal plane at its lower end was solved using the complex potential function. The complex potential is a function of position and can be used to determine the hydraulic potential, the stream function, and the velocity distribution. The flow velocity and direction are closely related to movement of chemical constituents into and from the soil surface, amount of subsurface flow and surface flow, erosion hazards and seepage spots. Two cases were considered: in the first a straight slope of finite length intersects an infinitely wide horizontal plane; in the second, a horizontal plane of finite width is between two symmetric hillsides. Flow nets and graphical relations show the flow patterns. (Knapp-USGS)
W73-11212

SIMULTANEOUS TRANSPORT OF CHLORIDE AND WATER DURING INFILTRATION,

California Univ., Davis. Dept. of Water Science and Engineering.

For primary bibliographic entry see Field 02K.

W73-11213

INFLUENCE OF SOIL TEMPERATURE AND MOISTURE ON SURVIVAL AND GROWTH OF STRANDS OF PHYMATOTRICHUM OMNIVORUM,

Ruhr-Universitaet Bochum (West Germany). Lehrstuhl fuer Pflanzenphysiologie.

For primary bibliographic entry see Field 03F.

W73-11248

RETENTION AND RELEASE OF SOIL WATER AS RELATED TO MINERALOGY OF THE SOIL CLAYS,

Indian Agricultural Research Inst., New Delhi. Div. of Soil Science and Agricultural Chemistry.

M. H. Ali, and T. D. Biswas.

J Indian Soc Soil Sci. Vol 19, No 4, p 363-368. 1971. Illus.

Identifiers: *Clays (Bentonite), Illite, Kaolinite, Mineralogy, Montmorillonite, Retention, *Soil water.

Retention and release of water were maximum in bentonite (clay) followed by illite and kaolinite. With rise in matrix suction, the difference in the retention by these clay minerals decreased. At 10 centibar, bentonite retained 244% more water than kaolinite, whereas at 15 bar, it was merely 9%. The black soils, being very fine textured and having montmorillonite as the dominant clay mineral, retained and released the largest amount of water, followed, in general, by the alluvial (illitic) and lateritic (kaolinitic) soils. Moreover, the water retention curves of the black, alluvial, red and lateritic soils resemble those of bentonite, illite, and kaolinite respectively. Both the nature and amount of the clays are important factors in determining the water retention characteristics of soils.—Copyright 1972, Biological Abstracts, Inc.
W73-11256

MORPHOLOGY AND DISTRIBUTION OF SOILS OF LOWER IB WATERSHED,

Indian Agricultural Research Inst., Nagpur. All India Soil and Land Use Survey.

J. C. Bhattacharjee, N. K. Shende, N. K. Barde, and T. B. Raut.

J Indian Soc Soil Sci. Vol 19, No 4, p 423-439. 1971. Illus.

Identifiers: Distribution, *India (Ib watershed), Morphology, *Soils, Watersheds.

Widely different soils following sequences of geomorphic components were recognized and arranged in 2 catenas in lower Ib watershed covering parts of the districts of Sundergarh and Sambalpur in Orissa State (India). Topographic variations regulate hydrological conditions modifying soil climate as locally arid or locally humid which, in turn, influences pedogenic processes. Morphological features like depth, color distribution of clay in profiles, etc. and also physico-chemical properties of different members of these 2 catenas distinctly indicate the heterogeneity in soil development and reflect direct relationship with different hydrological conditions modifying soil climate due to topographical variations, while overhead climate and parent materials are of subsidiary values.—Copyright 1972, Biological Abstracts, Inc.
W73-11258

INVESTIGATION ON ERODIBILITY AND WATER STABLE AGGREGATES OF CERTAIN SOILS OF EASTERN NEPAL,

Soil Conservation Research, Demonstration and Training Center, Chatra (Nepal).

For primary bibliographic entry see Field 02J.

W73-11272

MEASUREMENT OF CONTACT ANGLE OF WATER IN SOILS AND SAND,

Indian Inst. of Tech., Kharagpur. Dept. of Agricultural Engineering.

Dhan Pal, and S. B. Varade.

J Indian Soc Soil Sci. Vol 19, No 4, p 339-343. 1971.

Identifiers: *Contact angle (Water), Equations, Measurement, Poiseuille's equation, *Sand, *Soils.

The contact angle of water in soils and sand was measured using the infiltration and capillary rise method respectively. The contact angle of water to the soil is not 0 and even in wettable soil the effective contact angle is much larger. The order of magnitude of the soil-water contact angle among 5 soils was as follows: Sandy loam soil > red soil > laterite soil > black soil > clay soil. In sand, the magnitude of contact angle was not influenced by the treatment of hydrophobic substance such as pyrogallol used in present study. The Poiseuille's

Field 02—WATER CYCLE

Group 2G—Water in Soils

equation worked well for soils but not for pure sand.—oCopyright 1972, Biological Abstracts, Inc. W73-11273

DETERMINATION OF TRACE MERCURY IN SOIL AND ROCK MEDIA,
Colorado School of Mines, Golden. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W73-11297

INCIDENCE OF MERCURY IN ILLINOIS PHEASANTS,
Illinois State Natural History Survey, Urbana.
For primary bibliographic entry see Field 05A.
W73-11305

POSSIBILITY OF REDUCING NITROGEN IN DRAINAGE WATER BY ON FARM-PRACTICES, (BIO-ENGINEERING ASPECTS OF AGRICULTURAL DRAINAGE, SAN JOAQUIN VALLEY, CALIFORNIA).
Bureau of Reclamation, Fresno, Calif.
For primary bibliographic entry see Field 05B.
W73-11324

CAPILLARY-DIFFUSION AND SELF-DIFFUSION OF LIQUID WATER IN UNSATURATED SOILS,
Kentucky Univ., Lexington. Dept. of Agronomy.
V. L. Quisenberry, Jr.
M Sc Thesis, 1971. 79 p, 18 fig, 31 ref. OWRR A-011-KY (2).

Descriptors: *Soil moisture, *Diffusion, *Capillary water, *Unsaturated flow, *Kentucky, Soils, Soil water movement, Saturated flow, Laboratory tests, Analytical techniques, Inflow, Discharge (Water), Moisture content, Agriculture.
Identifiers: Diffusion coefficients (Soils).

Capillary-diffusion and self-diffusion coefficients were determined by laboratory methods for several Kentucky soils: Maury silt loam, Pembroke silt loam, Eden silty clay loam, Burin silty clay loam, Henry silt loam, Huntington loam, and Yolo loam. Capillary-diffusion coefficients were measured by use of inflow and outflow methods. With both methods the capillary-diffusion coefficients decreased very rapidly with decreasing water content. The soils with lower clay contents had higher diffusion coefficients over the entire moisture content range studied, 0 to 1 bar tension, than the soils with the higher clay contents. A comparison of the two methods showed that the inflow method yielded slightly higher capillary-diffusion coefficients for the Yolo, Huntington, and Pembroke. The inflow method gave coefficients about an order of magnitude greater than the outflow method for the Burin silty clay loam. This difference was explained on the basis of the swelling property of the dominant clay mineral in the soil, montmorillonite. The two methods yielded approximately the same values for the Maury and the Eden. (Woodard-USGS)
W73-11390

THE CLASSIFICATION OF ARID ZONE SOILS: I. AN APPROACH TO THE CLASSIFICATION OF ARID ZONE SOILS USING DEPOSITIONAL FEATURES,
Hunting Technical Services Ltd., Boreham Wood (England).

S. Western.
J Soil Sci., Vol 23, No 3, p 266-278, 1972. Illus.
Identifiers: Aeolian, Anthropic, Arid zones, Classifications, Depositional features, Depth, Fluvial, Irrigation, Littoral, Salinity, *Soils (Arid zone), Stratification, Texture, *Soil classification, Sediments.

Soils in regions of arid and semi-arid climates exhibit only limited pedogenetic profile development, and they might be more usefully described, classified and mapped in terms of their depositional character. The main source of understanding of their origins and practical significance is likely to be the sedimentary geomorphology of the area concerned, rather than the minimal pedogenetic features. The term 'sedosols' is proposed for these soils and a method of classification is outlined, based on depositional features and origins. Sub-orders are based on mode of deposition to give 4 sedimentary families, viz. fluvial, littoral, aeolian, and anthropic. In lower category classification, series based on pedogenetic features cannot be defined and are replaced by the 'depositional series' characterized by the types of sediment (e.g. coarse textured, fine textured, saline, non-saline). Typical phases are based on soil depth and degree of erosion. Salinity induced by irrigation is also best recognized at phase level as it is essentially an ephemeral feature. The 3 major differentiating characteristics of sedosols are soil texture, degree of depositional stratification and effective soil depth. (See also W73-11418)—Copyright 1973, Biological Abstracts, Inc.
W73-11417

THE CLASSIFICATION OF ARID ZONE SOILS: II. THE CLASSIFICATION OF SEDOSOLS IN SOUTH ARABIA,
Hunting Technical Services Ltd., Boreham Wood (England).
S. Western.
J Soil Sci., Vol 23, No 3, p 279-297, 1972. Illus.
Identifiers: *Arabia, Arid zones, Deposition, Mapping, Moisture, Morphology, Sedimentary, *Sedosols, *Soils (Arid zone), *Soil classification.

In the arid environment of South Arabia the soils (sedosols) are not significantly affected by pedogenetic processes. Classification of these soils is therefore in accordance with the principles based upon a consideration of the mode of deposition rather than on considerations of pedogenesis. Sedimentary geomorphology, soil classification, soil mapping are discussed for 2 areas of South Arabia. Mapping purity was satisfactory and reliability was probably greatest in series that were wholly anthropic or wholly natural in origin. In classifying land for single-flood irrigation agriculture, the total readily available moisture capacity is the major land classification factor. It is a function of texture and effective depth, modified in places by severe stratification. (See also W73-11417)—Copyright 1973, Biological Abstracts, Inc.
W73-11418

ADSORPTION CHARACTERISTICS OF OPALINE CLAYS FROM THE EOCENE OF GEORGIA,
Georgia Univ., Athens.
R. E. Carver.

In: Proceedings of the Seventh Forum on Geology of Industrial Minerals, April 28-30, 1971, Tampa, Florida; Florida Department of Natural Resources Special Publication No 17, p 91-101, June 1972. 5 fig, 5 tab, 11 ref. OWRR A-006-GA (11).

Descriptors: *Adsorption, *Moisture uptake, *Clays, *Mineralogy, Georgia, Adsorption, Physical properties, Chemical properties, Analytical techniques, X-ray diffraction, Porosity, Water vapor, Correlation analysis, Montmorillonite, Quartz, Industrial production.
Identifiers: *Fuller's earth, Opaline clays, Ethylene glycol.

Opaline clays from central and eastern Georgia are widely used as industrial and domestic absorbents, principally as insecticide carrier and animal litter. The clays are classified as fuller's earth, although they are somewhat atypical of the group, since opal (cristobolite) is commonly the dominant clay-

sized mineral. An investigation of absorption characteristics indicated that water vapor absorption (264 days) is related to opal content as determined by x-ray diffraction peak height ratios. Ethylene glycol vapor absorption is related to montmorillonite content. Contact absorption of water is complexly related to surface absorption, porosity, opal content and montmorillonite content, and may be as great as 112% of the original sample weight. The most absorbent clays are highly porous (to 65%) and contain both montmorillonite and opal. (Woodard-USGS)
W73-11536

RELATIONSHIPS BETWEEN MOISTURE RETENTION AND PARTICLE SIZE DISTRIBUTION OF THE SOIL,
Fort Hare Univ. (South Africa). Facultas Landbau.

H. V. H. Van Der Watt.
Agrochemophysica Vol 3, No 2, p 33-34, 1971.
Identifiers: Distribution patterns, Hydrometer methods, *Soil moisture, Retention, Soils, *Soil particle size, *Regression analysis.

In the soils examined, moisture retention and 'available moisture' can be estimated with fair accuracy from particle size distribution. The latter is determined by Van der Watt's (1966) hydrometer method. Data collected were subjected to multiple linear regression analysis with an IBM 1130 computer.—Copyright 1972, Biological Abstracts, Inc.
W73-11634

2H. Lakes

COMPUTER SIMULATION OF EUTROPHICATION,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
W73-11051

AN IN SITU EVALUATION OF NUTRIENT EFFECTS IN LAKES,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 05C.
W73-11070

PHOSPHORUS RELEASE FROM LAKE SEDIMENTS,
Battelle-Pacific Northwest Labs., Richland, Wash.
For primary bibliographic entry see Field 05C.
W73-11072

ACCRETION RATES OF FRESHWATER MANGANESE DEPOSITS,
Tata Inst. of Fundamental Research, Bombay (India).
For primary bibliographic entry see Field 02J.
W73-11088

EFFECTS OF SUBMERGED SILLS IN THE ST. CLAIR RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08B.
W73-11089

PARTITIONING OF A BRACKISH WATER HABITAT BY COPEPOD SPECIES,
Ghent (Belgium). Dept. of Zoology Rijksuniversiteit.
For primary bibliographic entry see Field 05A.
W73-11130

WATER CYCLE—Field 02
Lakes—Group 2H

ISOLATION OF SALMONELLA FROM MODERATELY POLLUTED WATERS,
Department of the Environment, Burlington (Ontario). Centre for Inland Waters.
For primary bibliographic entry see Field 05A.
W73-11134

WATER QUALITY MODELS FOR TOTAL COLIFORM,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W73-11135

BATHYMETRIC RECONNAISSANCE OF WILD HORSE RESERVOIR, ELKO COUNTY, NEVADA,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 07C.
W73-11219

BATHYMETRIC RECONNAISSANCE OF WEBER RESERVOIR, MINERAL COUNTY, NEVADA,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 07C.
W73-11220

THE EVOLVING ROLE OF THE FEDERAL GOVERNMENT IN THE MANAGEMENT OF LAKE MICHIGAN,
Michigan Univ., Ann Arbor. School of Natural Resources.
For primary bibliographic entry see Field 06E.
W73-11247

LIMNOLOGY OF YELLOWTAIL RESERVOIR AND THE BIG HORN RIVER,
Montana State Univ., Bozeman.
For primary bibliographic entry see Field 05C.
W73-11331

CIRCULATION PATTERNS IN LAKE SUPERIOR,
Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
S. L. Lien.

Ph.D. Thesis, 1973. 202 p, 3 tab, 70 fig, 64 ref, 3 append. OWRR B-009-WIS (6). 14-01-0001-1057.

Descriptors: Lakes, Mixing, Water circulation, Stratification, Movement, Winds, Bathymetry, Water temperature, Water currents, Coriolis force, Model studies, Lake Superior, Mathematical models, Energy transfer.
Identifiers: Keweenaw Peninsula, Isle Royale.

Lake circulation studies were directed toward Lake Superior for the purpose of broadening the quantitative understanding of large-scale circulation patterns induced by wind and atmospheric pressure variations over lakes under homogeneous conditions. The effects of lake geometry—both horizontal and depth variation—of bottom conditions—slip or no-slip—and of wind stress distributions on the movement of water are considered. Because of the large-scale water motion, Coriolis forces were included in the models. An iteration scheme is used for the numerical solution of steady-state flow conditions in a homogeneous lake, and an explicit scheme is applied to the transient flow situation. Laboratory results generated on a physical rotary, vertically distorted model of Lake Superior indicate the patterns that result from wind-generated circulation. Uniform density conditions occur in the lakes during the late fall and spring seasons. By using a diverse approach of combining many sampling techniques and methods of analysis, it was possible to detect and define the nature of the temperature and current patterns for the study area. (Kerrigan-Wisconsin)

W73-11342

PRESERVATION OF LAKE BAYKAL (OB OKHRANE OZERA BAYKAL),
Hydrometeorological Service of the USSR, Moscow.
For primary bibliographic entry see Field 05C.
W73-11407

DISTRIBUTION OF TRACE ELEMENTS IN BODIES OF WATER OF KAZAKHSTAN (RAS-PREDNEIYE MIKROELEMENTOV V VODOYEMAKH KAZAKHSTANA),
Akademi Nauk Kazakhskoi SSR, Alma-Ata. Institut Khimicheskikh Nauk.
For primary bibliographic entry see Field 02K.
W73-11413

MAJOR AND TRACE ELEMENT LOADING OF CENTRAL MICHIGAN LAKES,
Michigan State Univ., East Lansing. Dept. of Geology.
For primary bibliographic entry see Field 05B.
W73-11427

PREIMPOUNDMENT STUDY, CARTERS LAKE,
Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.
For primary bibliographic entry see Field 06G.
W73-11530

BATHYMETRIC RECONNAISSANCE OF LAKE TAHOE, NEVADA AND CALIFORNIA,
Geological Survey, Carson City, Nev.
F. E. Rush.
Nevada Division of Water Resources, Water Resources-Information Series Report 17, 1973. 1 sheet, 6 fig, 3 tab, 8 ref.

Descriptors: Lake morphology, Lake bathymetry, Bathymetry, Hydrologic data, Water quality, Water temperature, Sedimentation, Inflow, Discharge (Water), Streamflow, Dam design, Water levels, Precipitation (Atmospheric), California, Nevada.
Identifiers: Lake Tahoe (Calif and Nev).

This bathymetric map (scale 1:62,500) of Lake Tahoe in California and Nevada is based on a soundings map of the U.S. Coast and Geodetic Survey (1923). The deepest sounding in the lake, 1,646 feet and the only sounding greater than 1,600 feet, was about 6 miles due east of the Truckee River outlet and along the axis of the lake. Most of the steep slopes shown by the close spacing of the bathymetric contours on the east and west sides of the lake are of fault origin. In addition, a fault scarp extends southward from Stateline Point at the north end of the lake towards the deepest point in the lake. About 2 miles north of Emerald Bay at Rubicon Point, the lake depth increases 1,300 feet in about the same horizontal distance, producing a bottom slope of about 45 deg from horizontal. Smaller maps and illustrations show general distribution of lake-bottom sediments; approximate mean annual precipitation in the Lake Tahoe basin; mean monthly flow of Upper Truckee River near Meyers, California; flow from Lake Tahoe to Truckee River; and annual variations in stage of Lake Tahoe. Summary tables are presented for lake morphology, water temperature, water quality, light penetration, and dam design. (Woodard-USGS)
W73-11531

SEISMIC SEICHES IN BAYS, CHANNELS, AND ESTUARIES,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
A. McGarr, and R. C. Vorhis.

In: The Great Alaska Earthquake of 1964: Oceanography and Coastal Engineering: National Academy of Sciences, Washington, D.C., p 25-28, 1972. 2 fig, 1 tab, 3 ref.

Descriptors: Seismic waves, Earthquakes, Alaska, Seiches, Frequency, Waves (Water), Tides, Surges, Water level fluctuations, Coasts, Lakes, Rivers, Reservoirs, Seismic properties, Travel time.

The great Alaska earthquake of 1964 produced seismic waves so large that they set bodies of water into oscillation throughout much of North America. Seismic surface waves, of both Love and Rayleigh types, were primarily responsible for the oscillations, or seiches, because these generally cause the largest amplitude of ground motion of all seismic waves at great distances from an epicenter. As the seismic surface waves passed beneath water-filled basins, their horizontal components generated the seiches. The surface waves most effective in the production of seiches had periods of the order of 15 seconds (or wavelengths of about 50 km). The distribution of seismic seiches in coastal regions is described and some features of the distribution are explained. A map shows seismic seiches from the Alaska earthquake recorded in conterminous United States. (Woodard-USGS)
W73-11532

REMOTE SENSING EVALUATION OF ENVIRONMENTAL FACTORS AFFECTING THE DEVELOPMENTAL CAPACITY OF INLAND LAKES,
Toronto Univ. (Ontario). Inst. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 07B.
W73-11540

RESERVOIR BANK STORAGE,
Geological Survey, Menlo Park, Calif.
T. H. Thompson.

Available from NTIS, Springfield, Va 22151, as PB-214 416. Price \$3.00 printed copy; \$0.95 microfiche. Computer Contribution No 24, November 1972. 29 p, 1 fig, 5 ref, 2 append.

Descriptors: Reservoir storage, Hydrologic data, Water level fluctuations, Reservoirs, Model studies, Computer models, Input-output analysis, Water inflow, Discharge (Water), Water yield, Hydrologic budget, Bank storage, Surface-groundwater relationships.
Identifiers: FORTRAN language.

A digital computer program is presented for computing daily bank storage from changes in reservoir surface elevations where the reservoir is bounded by a wedge-shaped aquifer of finite width. Cumulative bank-storage volumes are computed for two sets of transmissivity and storage coefficients. Each set is multiplied by a constant selected by the user and the volumes are then combined. A table of daily reservoir elevations, changes in elevations, changes in bank-storage volume, and total cumulative bank-storage volume at the end of each day is printed. A listing of the computer program is given at the end of the report along with sample input data and program output. (Woodard-USGS)
W73-11542

DRAININGS OF ICE-DAMMED SUMMIT LAKE, BRITISH COLUMBIA,
Department of the Environment, Ottawa (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 02E.
W73-11547

Field 02—WATER CYCLE

Group 2H—Lakes

ANALYSIS OF LAKE ERIE WAVE PRESSURE DATA,
Northern Illinois Univ., De Kalb. Dept. of Geography.
For primary bibliographic entry see Field 06B.
W73-11548

A NEW CRAYFISH OF THE SUBGENUS JUGICAMBARUS FROM TENNESSEE WITH AN EMENDED DEFINITION OF THE SUBGENUS (ASTACIDAE, DECAPODA),
Tennessee Univ., Knoxville. Dept. of Zoology and Entomology.
For primary bibliographic entry see Field 05A.
W73-11590

NUTRIENT RATIO VARIATION IN RESERVOIR SEDIMENTS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 05B.
W73-11591

MEASUREMENT OF EXCHANGEABLE INORGANIC PHOSPHATE IN LAKE SEDIMENTS,
Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 05A.
W73-11596

SPRING PHYTOPLANKTON ABUNDANCE AND PRODUCTIVITY IN GRAND TRAVERSE BAY, LAKE MICHIGAN, 1970,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 05B.
W73-11629

EPIDEMIOLOGICAL STUDY ON CLONDORCHIS SINENSIS AROUND LAKE BIWA, SHIGA PREFECTURE: I. SURVEY ON DISTRIBUTION OF PARAF OSSAROLUS MANCHOURICUS, THE FIRST INTERMEDIATE HOST SNAIL (IN JAPANESE),
Kyoto Prefectural Univ. of Medicine (Japan).
M. Nagahana, Y. Yoshida, H. Sugihara, K. Matsuo, and K. Kondo.
Jap J Parasitol, Vol 20, No 2, p 103-108, 1971, Maps, English summary.
Identifiers: Clondorches-sinensis, Distribution patterns, Epidemiological studies, Host, Lakes, Parafossarulus-manchouricus, "Snails, Survey, *Japan (Lake Biwa).

Of 97 stations investigated around the lake, 39 were positive for the snail. The fact that the snail host is distributed widely and abundantly in this lake suggests the possibility of further expansion of *C. sinensis* in this area. The effect of reclamation work and industrialization on the snail population should be considered.—Copyright 1972, Biological Abstracts, Inc.
W73-11654

FORECASTING QUARTERLY INFLOW OF WATER TO DNEIPER RIVER RESERVOIRS DURING THE COLD HALF OF THE YEAR (O PROGNOZIROVANII KVARTAL'NOGO PRITOKA VODY V DNEPROVSKIE VODOKHRANILISHCHA ZA KOHODNUYU POLOVINU GODA),
Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).
M. V. Rudometov.
In: Formirovaniye i prognozy elementov gidrologicheskogo rezhima rek; Ukrainskiy Nauchno-Issledovatel'skiy Gidrometeorologicheskii Institut Trudy, No 112, p 27-43, Moscow, 1972. 5 fig, 7 tab, 4 ref.

Descriptors: *Forecasting, *Inflow, *Reservoirs, *Reservoir storage, Water storage, Discharge

(Water), Soil moisture, Field capacity, Watersheds (Basins), Channels, Tributaries, Monthly Curves.
Identifiers: *Ukraine, *Dnieper River.

Investigations to develop predictive relations for average quarterly discharge (in monthly increments) of inflow to the Kiev, Kanev, and Kremenchug Reservoirs for the last quarter of one year and the first quarter of the next were based on calculated relations constructed from data for 1933-40 and 1944-68. The factors used were water storage in the basin and water storage in the channel at the end of the preceding quarter. The relations examined for the Kiev and Kanev Reservoirs can be used to prepare sufficiently accurate forecasts of quarterly inflow in monthly increments for the fourth quarter but only tentative forecasts of inflow for the first quarter. For the Kremenchug Reservoir, sufficiently accurate forecasts of tributary inflow for the fourth quarter can be prepared, although use of these forecasts is considered inexpedient, since this inflow is small with respect to main-stream flow. (See also W73-11688) (Josephson-USGS)
W73-11691

2I. Water in Plants

PARASITE COPEPODS OF SOME FRESH-WATER FISHES FROM NORTH CAROLINA,
Louisburg Coll., N.C.
K. W. Burris, and G. C. Miller.
J Elisha Mitchell Sci Soc Vol 88, No 1, p 18-20, 1972.
Identifiers: *Copepods, Fishes, New, *North Carolina, *Parasites.

During the summer of 1971, a study was made of the parasitic copepods found on 209 fishes representing 10 families and 28 species. Collections were made in 6 counties in North Carolina. Of the fishes, 36% were infested with 10 species of copepods belonging to 3 families and 3 genera. Twelve new host parasite records are reported, and North Carolina represents new locality records for all 10 species of copepods.—Copyright 1972, Biological Abstracts, Inc.
W73-11143

SEASONAL EMERGENCE OF SOME HIGH ARCTIC CHIRONOMIDAE (DIPTERA),
Waterloo Univ. (Ontario). Dept. of Biology.
H. V. Danks, and D. R. Oliver.
Can Entomol, Vol 104, No 5, p 661-686, 1972. Illus.

Identifiers: *Arctic, *Chironomidae, Diapause, *Diptera, Seasonal, Synchronized, Temperature.

The annual emergence of 11 chironomid species from shallow ponds in the area of Hazen Camp (81 degree 49'N, 71 degree 18'W) is considered. Features of emergence are very similar in all these arctic species, although different species emerge at slightly different times in the same habitat. In the deeper habitats, emergence from a deep site is slightly later than that from a shallower one in the same pond. There are very marked differences in times of emergence from pond to pond: emergence of 50% of the annual total for a given species may be reached in different ponds up to 3 wk apart. These differences from habitat to habitat mean that adults are present over the general Hazen area throughout the arctic summer. The time at which emergence begins in a given pond (or given site within a deeper pond) is primarily dictated by the temperature required for preemergence development, but also by other features of individual ponds. Pond temperatures near 4 or 5 C are most important in this respect. The time of first emergence differs between years in the same pond according to year-to-year temperature differences. Emergence of a given species is basically highly synchronized within a pond, but the emergence

period may be prolonged by lowered temperatures acting as a threshold for adult emergence at about 7 C. The emergence pattern is less regular in shallow ponds in which the temperature fluctuates greatly, and it is more regular with lower peaks in deeper ponds. Males of a number of species generally emerge slightly before the females. Aquatic insect species are characterized as absolute spring species if all potential emergents overwinter as mature larvae (i.e., larvae in which no further growth is necessary before emergence) and also 'diapause' is present at this stage. To this category all of these high arctic species belong. They are apparently derived from 'absolute spring species' farther south, the life-cycles of which are preadapted to the shortness of the arctic season. Despite the potential for highly synchronized emergence which such species possess, this potential is not fully realized in the arctic because the irregular fluctuations of temperature there operate near values which may directly inhibit development and emergence.—Copyright 1972, Biological Abstracts, Inc.
W73-11148

PARASITES OF FISH FROM LAKE OF THE WOODS, ONTARIO,
Department of Lands and Forests, Maple (Ontario). Research Branch.

A. O. Dechtiar.
J Fish Res Board Can. Vol 29, No 3, p 275-283, 1972.
Identifiers: *Canada (Ontario), *Fish parasites, *Helminths, Human health, *Lake of the Woods, Parasites.

Results of a survey of the parasite fauna of fish from Lake of the Woods and adjacent lakes are presented. Over 600 fish representing 41 species were examined, and 170 species of parasites, mostly helminths, are recorded. Every species of fish and 97% of all fish examined carried at least 1 parasite. No parasites considered hazardous to human health were found. A number of parasites, reported elsewhere as contributors to fish mortalities, are recorded.—Copyright 1972, Biological Abstracts, Inc.
W73-11172

SOIL PHYSICAL FACTORS AFFECTING ROOT MORPHOLOGY AND STABILITY OF SCOTS PINE ON UPLAND HEATHS,
For primary bibliographic entry see Field 04A.
W73-11173

WATER POTENTIALS IN NONWILTED DIANTHUS GROWN IN DIFFERENT NUTRIENT SOLUTION CONCENTRATIONS,
Washington State Univ., Pullman.
K. A. Schekel, and J. J. Hanan.
Agron J. Vol 64, No 4, p 440-443, 1972. Illus.

Identifiers: Aperture, *Dianthus-Caryophyllus-D, Evaporation, Hydrostatic potential, Nutrients, Pressure, Stomata, Transpiration, Turgor, Xylem, Osmotic potential (Plants).

Experiments were undertaken to determine if *Dianthus caryophyllus* L. adjusted its internal osmotic potential downward with decreasing solution potential and the concomitant effects on water and turgor potentials. Plants were grown in a gravel substrate, irrigated 2-4 times daily with solutions of varying potentials, and measurements were made from before sunrise to noon or shortly thereafter on clear days. Plant osmotic potentials adjusted to increase the potential gradient between solution and plant with decreasing solution potential. There were no observable differences between treatments with respect to stomatal aperture or leaf diffusion resistance. The xylem hydrostatic pressure decreased to a greater extent in plants grown in -0.3 bar solutions than in those grown in -0.3 bar solutions as atmospheric evaporative demand increased. Polynomial regres-

WATER CYCLE—Field 02

Erosion and Sedimentation—Group 2J

sions of potential on evaporative demand had calculated correlations exceeding 0.90. Differentiation to determine the rate of hydrostatic potential change with change in evaporative demand showed the rate to be highest at low evaporative demands in plants grown in -1.0 bar solutions, gradually decreasing to 0 at high vapor pressure differences near 16 mm Hg. Carnations in -0.3 bar solutions had rates approaching 0 at low and high atmospheric demands, with a definite maximum near 9-10 mm Hg. The differences between hydrostatic potential and plant osmotic potential, ignoring matric and xylem potentials, showed carnations in -1.0 bar solutions to have consistently lower turgor potentials than plants grown in less concentrated solutions.—Copyright 1972, Biological Abstracts, Inc.
W73-11191

LEAD ACCUMULATION WITHIN NUCLEI OF MOSS LEAF CELLS,
Norges Tekniske Høgskole, Trondheim. Dept. of Physics.
For primary bibliographic entry see Field 05E.
W73-11276

LEAD POLLUTION FROM A FACTORY MANUFACTURING ANTI-KNOCK COMPOUNDS,
Manchester Univ. (England). Dept. of Botany.
For primary bibliographic entry see Field 05B.
W73-11290

THE FOOD OF BROWN TROUT IN LLYN ALAW, ANGLESEY, NORTH WALES,
Liverpool Univ. (England). Dept. of Zoology.
P. C. Hunt, and J. W. Jones.
J Fish Biol Vol 4, No 2, p 333-352. 1972. Illus.
Identifiers: *Fish diet, Bottom fauna, *Brown trout, Trout, Wales (Llyn Alaw).

The results of the analysis of the contents of 274 brown trout stomachs taken over a period of 1 yr from Llyn Alaw, in Anglesey, North Wales, are described. The annual composition and seasonal changes of the diet were determined using number, volume and occurrence methods. The bottom fauna is classified according to accessibility to the trout as food and the utilization and apparent selection of the fauna by the trout is discussed. Food in relation to trout size is considered in detail.—Copyright 1972, Biological Abstracts, Inc.
W73-11354

THE EFFECTS OF WATER STRESS ON NITROGEN-FIXING ROOT NODULES: II. EFFECTS OF THE FINE STRUCTURE OF DETACHED SOYBEAN NODULES,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
For primary bibliographic entry see Field 03F.
W73-11415

THE EFFECTS OF WATER STRESS ON NITROGEN-FIXING ROOT NODULES: III. EFFECTS OF OSMOTICALLY APPLIED STRESS,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
For primary bibliographic entry see Field 03F.
W73-11416

THE RESPONSE OF NATIVE MONTANA GRASSES TO SOIL WATER STRESS,
Montana State Univ., Bozeman. Water Resources Research Center.
L. Eddleman, and T. Nimlos.

Available from the National Technical Information Service as PB-221 538, \$3.00 in paper copy, \$0.95 in microfiche. Publication No. 37, 1972. 30 p., 6 tab, 52 ref. OWRR A-046-MONT (3).

Descriptors: *Soil moisture, *Soil water, Soil moisture meters, Montana, *Grasses, *Moisture stress, Drought tolerance, Water requirements, Soil-water plant relationships, Root development. Identifiers: *Root elongation, *Leaf elongation.

In central Montana the major species show differences in their site requirements. The stable communities serve to interpret the environmental conditions of the habitat. Available soil moisture is a major causal factor involved in species distribution and abundance. Water is now more indispensable to plants than is light or temperature, but it can be considered of great importance due to the involvement of water in a large number of vital functions. In regions of wet winters and dry summers especially, the soil acts as the reservoir supplying water to the plant during the growth season. Water available for plant growth is supplied as rain and snow during the wet season, and where it is not maintained during the dry season by ground water, the supply is gradually exhausted. The rate of use and time of exhaustion of the available moisture supply depends greatly on the physical and physiological characteristics of the species. By holding most environmental factors (light, temperature, soil characteristics, and photoperiod) approximately constant, the effects of the available soil moisture can be observed. This study was designed to monitor root elongation and leaf elongation of three grass species while growing in soils with favorable moisture conditions (control) and soils with decreasing soil water potential (treatment) brought about by the use of a nonrenewable moisture supply. (Holte-Montana)
W73-11429

APPLICATIONS OF MULTISPECTRAL REMOTE SENSING TECHNIQUES TO HYDROBIOLOGICAL INVESTIGATIONS IN EVERGLADES NATIONAL PARK,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 07B.
W73-11553

2J. Erosion and Sedimentation

NEUTRON ACTIVATION ANALYSIS OF BOTTOM SEDIMENTS,
Environmental Protection Agency, Athens, Ga.
Southeast Water Lab.
For primary bibliographic entry see Field 05A.
W73-11067

FLUVIAL SEDIMENT IN SIXMILE CREEK SUBWATERSHED 6, NEAR CHISMVILLE, ARKANSAS,
Geological Survey, Little Rock, Ark.
H. R. Fancher, Jr.
Open-file report, 1971. 26 p, 9 fig, 7 tab, 4 ref.

Descriptors: *Sediment load, *Trap efficiency, *Arkansas, Sedimentation, Reservoir silting, Sediment yield, Bed load, Suspended load, Sands, Particle size. Identifiers: *Sixmile Creek (Chismville Ark).

Fluvial sediments were measured in Sixmile Creek, Arkansas. From 1957 to 1970, 4,288 tons of suspended sediment discharged from subwatershed 6. During this time the average annual runoff was about 13.2 inches. Most of the sand carried into the reservoir was retained. The highest measured inflow-sediment concentration was 10,300 mg per liter. The highest measured outflow-sediment discharge was 49 tons. The trap efficiency of reservoir 6 was about 95% for the 14-year period of the study. (Knapp-USGS)
W73-11082

AN INVENTORY OF SUSPENDED SEDIMENT STATIONS AND TYPE OF DATA ANALYSIS FOR PENNSYLVANIA STREAMS, 1947-70,
Geological Survey, Harrisburg, Pa. Water Resources Div.

A. N. Ott, and A. B. Cummings.
Open-file report, 1972. 24 p, 4 fig, 4 ref.

Descriptors: *Suspended load, *Data collections, *Pennsylvania, Instrumentation, Hydrologic data, Measurement, Sampling.

This is a compilation of the location, period of record, sampling frequency and type of data synthesis for suspended sediment carried by Pennsylvania streams. Data concerning suspended-sediment concentrations and loads, frequency of occurrence of suspended-sediment concentrations, and long-term trends of annual suspended-sediment loads are important tools for environmental managers. These data are required background for those concerned with establishing and enforcing erosion and sedimentation control regulations and sediment concentration or turbidity standards for water-quality criteria, or those concerned with designing for adequate long-term water storage in reservoirs, or for efficient municipal and industrial plant operation. (Knapp-USGS)
W73-11083

ONSHORE-OFFSHORE SAND TRANSPORT ON DEL MONTE BEACH, CALIFORNIA,
Naval Postgraduate School, Monterey, Calif. Dept. of Oceanography.

J. D. Williamson.
Available from NTIS, Springfield, Va 22151 AD-751 595, Price \$3.00 printed copy; \$0.95 microfiche. M Sc Thesis, September 1972. 62 p, 10 fig, 1 tab, 22 ref, 3 append.

Descriptors: *Beach erosion, *Sediment transport, Data collections, Sedimentation, Profiles, Waves (Water), Slopes, Surf, Sampling, *California, Sands, Littoral drift.

Daily sand volume transport values were calculated at a beach profile during a 2-month period. Wave data were recorded continuously directly seaward of the profile. Tide effects were largely filtered out by use of a lunar day (24.8 hours) sampling interval. Offshore sand transport occurred in isolated events of 1- to 2-day duration, and had a maximum value of 132.5 cubic feet per foot of beach width per lunar day. Onshore transport occurred over longer intervals of up to 7 days, and had a maximum value of 47.0 cubic feet per foot per day. Onshore-offshore transport over a 24.8-hour period depends, to a first approximation, on the mean wave steepness incident upon the beach and the initial beach slope for the period. If the initial beach slope is greater than the equilibrium slope associated with the existing wave conditions, or if the profile is initially at equilibrium and the wave steepness increases, sand will be moved offshore. The closer to equilibrium the beach is, the smaller the transports. (Knapp-USGS)
W73-11086

ACCRETION RATES OF FRESHWATER MANGANESE DEPOSITS,
Tata Inst. of Fundamental Research, Bombay (India).

S. Krishnaswami, and W. S. Moore.
Nature Physical Science, Vol 243, No 129, p 114-116, June 18, 1973. 1 fig, 1 tab, 12 ref.

Descriptors: *Sedimentation, *Manganese, *Lakes, *Chemical precipitation, *Radioactive dating, Sedimentation rates, Bottom sediments, Radium radioisotopes. Identifiers: *Manganese nodules.

Growth rates of manganese nodules were studied by radiometric dating techniques which, coupled

Field 02—WATER CYCLE

Group 2J—Erosion and Sedimentation

with a knowledge of their chemical composition, provide information regarding elemental deposition rates and their geochemistry in lacustrine environments. Two nodules were studied, one spherical nodule of about 2-cm diameter from Lake Alster, Sweden, and a saucer-shaped concretion of about 2-cm thickness from Oneida Lake, New York (Dean nodule). The Ra-226 concentrations in both the nodules were very high, with a strong concentration gradient with depth. The Ra-226 activities in the nodules were much in excess compared to its parent, Th-230. The Ra-226 gradient in these concretions may be the result of radioactive decay. If this is true, the rate of accumulation of the nodules from Lakes Alster and Oneida is only 1 to 3 mm per 1000 years, and the age of each of these nodules is about 6,500 years. (Knapp-USGS) W73-11088

PRINCIPLES OF LANDSLIDE IDENTIFICATION FROM AERIAL SURVEY DATA (PRINTSIPI RASPOZNAVANIYA OPOLZNEVYKH PROTSESSOV PO MATERIALEM AEROFOTOS'YEMKI),
Moscow State Univ. (USSR). Chair of Gemorphology.
A. V. Sadov, and A. L. Revzon.
Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No 5, p 50-56, September-October 1972. 5 ref.

Descriptors: *Landslides, *Aerial photography, *Surveys, Remote sensing, Topography, Terrain analysis, Digital computers.
Identifiers: *USSR (Chatkal'skiy-Kuraminsky Mts.).

Identification of landslide processes from aerial photographic surveys was based on investigations in the Chatkal'skiy-Kuraminskiy mountain system in 1969-70. Identification of landslide processes has a complex hierarchical structure and is divided into a number of levels. Each level has its own alphabet of identifiable items, a list of features, and a set of gradations for these features. Results of the identification depend on technical conditions of the survey. Application of the principles of identification will increase reliability of landslide detection from aerial survey data, and the identification schemes developed will permit use of digital computers in processing the identifiable information. (Josefson-USGS)
W73-11100

UPPER PERMIAN GLACIOMARINE DEPOSITS IN THE KOLYMA RIVER BASIN (VERKH-NEPERMSKIE LEDOVO-MORSKIE OTLOZHENIYA BASSEYNA ISTOKOV R. KOLYMY),
Severo-Vostochnoe Territorialnoe Geologicheskoe Upravlenie, Magadan (USSR). O. G. Epshteyn.
Litologiya i Poleznye Iskopayemye, No 3, p 112-127, May-June 1972. 6 fig, 1 tab, 52 ref.

Descriptors: *Petrology, *Sediments, *Glacial sediments, *Glacial drift, *Geologic time, Paleozoic era, Structural geology, Rocks, Detritus, Granules, Particle size, Particle shape, Climatology, Ice, River basins, Chemical analysis.
Identifiers: *USSR (Kolyma River), *Permian period, Clastic sediments, Mudstones, Siltstones, Argillites, Slump (Mass movement), Volcanism, Paleogeography.

Upper Permian glaciomarine deposits possess all of the lithologic characteristics considered descriptive of present-day glaciomarine sediments. The postulate of a moderate or moderately cold climate in Late Permian time or, at any rate, for a considerable period of Kazanian time in the northeast USSR is being substantiated by lithologic evidence. Recurrent climatic fluctuations, reflected in the geologic profile by the presence of nonglacial deposits, occurred in Atkanian time together with changes in the ice conditions of the

marine basin. The Atka suite within the Ayan-Yuryakh anticlinorium in the Yana-Kolyma folded region represents an age of maximum ice movement in Late Permian time. The Upper Permian glaciomarine deposits examined are graphic illustrations of the effects which climatic factors have on terrigenous marine sedimentation. (Josefson-USGS)
W73-11103

EFFECTS OF LAND USE AND RETENTION PRACTICES ON SEDIMENT YIELDS IN THE STONY BROOK BASIN, NEW JERSEY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04C.
W73-11113

PHYSICAL EROSION AND DENUDATION RATES IN CARTWRIGHT BASIN AND VICINITY, WILLIAMSON COUNTY, TENNESSEE,
Vanderbilt Univ., Nashville, Tenn. Dept. of Geology.
D. B. Smith.

Tennessee Water Resources Research Center, Knoxville, Report No 22, December 1972. 60 p, 7 fig, 4 tab, 10 ref. OWRR B-018-TENN (1). 14-31-0001-3650.

Descriptors: *Erosion, *Sedimentation, *Sedimentation rates, *Tennessee, Watershed (Basin).
Identifiers: *Cartwright Basin (Tenn.), Williamson County (Tenn.), Franklin (Tenn.).

Physical erosion and denudation rates in a small carbonate stream basin were calculated from the amount of trapped sediment in farm ponds. Eight ponds within the basin and three just outside the basin yielded an average erosion rate 569 tons per square mile per year and a denudation rate 246 feet per million years (75.0 Bubnoff's). The lowest rate of sedimentation was 238 and the highest 1,180 tons/mi²/year with corresponding denudation rates from 102 to 310 ft/million years. These sedimentation rates are two to five times greater than those calculated theoretically from rates of chemical weathering and lithology. The observed sedimentation rates are believed to be enhanced by the influence of man. (Reesman-Vanderbilt)
W73-11140

EFFECT OF SOIL, COVER, SLOPE, AND RAINFALL FACTORS ON SOIL AND PHOSPHORUS MOVEMENT UNDER SIMULATED RAINFALL CONDITIONS,
Ohio State Univ., Columbus. Dept. of Agronomy.
For primary bibliographic entry see Field 05B.
W73-11208

PHOSPHORUS LOSSES FROM FOUR AGRICULTURAL WATERSHEDS ON MISSOURI VALLEY LOESS,
Agricultural Research Service, Lincoln, Nebr. North Central Region.
For primary bibliographic entry see Field 05B.
W73-11209

AN EVALUATION OF THE UTILITY OF AVAILABLE REMOTE SENSOR RETURNS FOR A STUDY OF SLOPE FAILURE PHENOMENA,
East Tennessee State Univ., Johnson City. Dept. of Geology.
For primary bibliographic entry see Field 07B.
W73-11216

BATHYMETRIC RECONNAISSANCE OF WEBER RESERVOIR, MINERAL COUNTY, NEVADA,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 07C.
W73-11220

INVESTIGATION ON ERODIBILITY AND WATER STABLE AGGREGATES OF CERTAIN SOILS OF EASTERN NEPAL,
Soil Conservation Research, Demonstration and Training Center, Chatra (Nepal).
D. C. Chakrabarti.

J Indian Soc Soil Sci. Vol 19, No 4, p 441-446. 1971.

Identifiers: Aggregates (Soil), Erodibility, *Nepal, *Soils (Forest), *Erosion ratio.

The values of certain indices of erodibility such as erosion ratio, dispersion ratio, clay ratio, etc. of the forest soils of Kosi catchment in eastern Nepal are lower than those of arable soils even though they are under unprotected forests. The forest soils contain higher percentage of water stable aggregates, organic C, Ca, P and higher exchange capacity than the arable soils. The values of E.R. (erosion ratio) tend to increase in arable soils and decrease in forest soils with increase in altitude. Besides E.R. value, other factors such as W.S. (water stable) aggregate, D.R. (dispersion ratio), organic C, etc. should be considered in erodibility studies of soils as they are closely correlated with E.R. The W.S. aggregate has been significantly correlated with water holding capacity, organic C, P, exchangeable Ca, cation exchange capacity, CEC, D.R. and suspension percentage but not with clay and free iron oxide.—Copyright 1972, Biological Abstracts, Inc.
W73-11272

MERCURY—A CASE STUDY OF MARINE POLLUTION,
World Health Organization, Copenhagen (Denmark). Regional Office for Europe.
For primary bibliographic entry see Field 05B.
W73-11375

MAN'S ROLE IN THE MAJOR SEDIMENTARY CYCLE,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 05B.
W73-11382

MANGANESE NODULES AND BUDGET OF TRACE SOLUBLES IN OCEANS,
Tata Inst. of Fundamental Research, Bombay (India).
For primary bibliographic entry see Field 05B.
W73-11384

THE USE OF MODERN CHROMIUM ACCUMULATIONS TO DETERMINE ESTUARINE SEDIMENTATION RATES,
New Hampshire Univ., Durham. Jackson Estuarine Lab.
For primary bibliographic entry see Field 02L.
W73-11392

SEDIMENTATION IN THE DEEP-SEA AREAS ADJACENT TO THE CANARY AND CAPE VERDE ISLANDS,
Heidelberg Univ. (West Germany). Sediment Research Lab.
P. Rothe.
Marine Geology, Vol 14, No 3, p 191-206, March 1973. 4 fig, 8 ref.

Descriptors: *Sedimentation, *Atlantic Ocean, Bottom sediments, Provenance, Mineralogy, Sedimentation rates.
Identifiers: Canary Islands, *Cape Verde Islands.

Bottom sediments between the eastern Canary Islands and Morocco are principally of continental-shelf derivation with little material from the islands. The sediment is mostly Globigerina ooze with silt-size quartz and much clay. Clay minerals are iron-rich chlorite, illite, and smectite. Sedimentation rates are about 2-3 cm/1,000 years. The

Erosion and Sedimentation—Group 2J

mineralogy of the Inner Cape Verde Basin sediments studied is different from that of the Canary Islands. Quartz and dolomite are uncommon. The clay minerals are rare chlorite, almost no illite, and some smectite. Amorphous silica is abundant. Volcanic sands are mixed with the shallow-water carbonates. This sediment distribution within the Inner Cape Verde Basin reflects a combination of open marine conditions and a chain of volcanic islands forming a barrier against terrigenous sedimentation from the African continent. Average sedimentation rates are between 2 and 3 cm/1,000 years. In the Canaries the principal constituents are terrigenous. In both areas, but particularly in the Cape Verdes, sedimentation is discontinuous, because the steady accumulation of the normal marine materials is interrupted by fluxes of reworked shallow-marine sand. (Knapp-USGS) W73-11393

SEDIMENTS IN THE ATLANTIC CORNER SEAMOUNTS: CONTROL BY TOPOGRAPHY, PALEO-WINDS, AND GEOCHEMICALLY-DETECTED MODERN BOTTOM CURRENTS, Rhode Island Univ., Kingston. Graduate School of Oceanography.

B. A. McGregor, P. R. Betzer, and D. C. Krause. *Marine Geology*, Vol 14, No 3, p 179-190, March 1973. 5 fig, 1 tab, 14 ref. ONR Contract N00014-68-A-0215-0003.

Descriptors: *Bottom sediments, *Atlantic Ocean, *Sedimentation, Erosion, Provenance, Ocean currents, Suspended load.

Identifiers: Corner seamount group.

The topography in the Corner seamounts area in the western North Atlantic was studied to determine its relationship to the sedimentation pattern. The areas of anomalously thick sediment accumulation that are found on the north side of the seamounts are related to volcanic activity as well as paleocurrent and wind patterns. An irregular sediment surface has been formed by slump structures and actively eroding bottom currents. The erosion also results in high particulate iron concentrations in the bottom water. (Knapp-USGS) W73-11394

THE U.C.S. GRAIN-SIZE COMPARATOR DISC, Unit of Coastal Sedimentation, Taunton (England).

For primary bibliographic entry see Field 07B.

W73-11395

ROLE OF IRON SULFIDES IN THE ACCUMULATION OF TRACE ELEMENTS IN BLACK SEA SEDIMENTS (ROL' SUL'FIDOV ZHELEZA PRI NAKOPENNI MIKROELEMENTOV V OSADKAKH CHERNOGO MORYA), Akademiya Nauk SSSR, Moscow. Institut Okeanologii.

L. I. Volkov, and L. S. Fomina.

Litologiya i Poleznye Iskopayemye, No 2, p 18-24, March-April 1972. 2 tab.

Descriptors: *Geochemistry, *Trace elements, *Sediments, *Sulfides, *Iron, Hydrogen sulfide, Pyrite, Molybdenum, Cobalt, Nickel, Copper. Identifiers: USSR, *Black Sea.

The content of Mo, Co, Ni, and Cu was investigated in pyrite samples collected from recent deep-sea sediments in the hydrogen sulfide zone of the Black Sea. The CoO concentration in pyrite is 0.01%-0.025% (average 0.017%), and the average coefficient of accumulation in deep-water pyrite is 9.3 (3.8-15.6). The NiO concentration in pyrite is 0.041%-0.402% (average 0.15%), and the coefficient of accumulation varies between 2.6 and 40. The CuO concentration in pyrite is 0.083%-0.195% (average 0.128%), and the average coefficient of accumulation is 20.5 (14.5-33.1). Very high and absolute concentrations of MoO₃ (0.023%-0.137%)

occur in pyrite, and the coefficient of accumulation in the different samples varies between 8.2 and 61.4 (average 35.8). The concentrations and coefficients of accumulation of these metals are much lower in pyrite and iron sulfides of Neoeuxinic deposits than in those of recent deep-sea sediments. (Josefson-USGS) W73-11409

CONDITIONS OF PRESERVATION OF CHLOROPHYLL, PHEOPHYTIN, AND HUMIC SUBSTANCES IN BLACK SEA SEDIMENTS (USLOVIYA SOKHRANNOSTI KHLOROFILLA, FEOPHYITINA I GUMINOVYKH VESHCHESTV V OTLOZHENIYAKH CHERNOGO MORYA), Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii.

T. V. Drozdova, and Yu. N. Gurskiy.

Geokhimiya, No 3, p 323-334, March 1972. 1 fig, 3 tab, 24 ref.

Descriptors: *Sediments, *Geochemistry, *Organic matter, *Humic acids, *Chlorophyll, Pigments, Sedimentation, Sedimentation rates, Diagenesis, Facies (Sedimentary), Chemical reactions, Oxidation-reduction potential, Hydrogen sulfide, Sampling, Cores, Analytical techniques. Identifiers: USSR, *Black Sea, *Pheophytin, Organic carbon, Sapropel.

Distribution of organic matter and its components (chlorophyll, pheophytin, and humic acids) was investigated in different facies of Black Sea sediments. Samples collected from the surface of sediments and from cores up to 3.5 m in length were taken at depths ranging from 20 to 2,140 m. Chlorophyll and pheophytin were separated by paper chromatography and determined spectrophotometrically before and after oxidation of chlorophyll. A direct relation is observed between organic carbon and the contents of humic acids and chlorophyll-like pigments in all samples. Maximum concentrations of organic carbon (up to 20%), humic acids (up to 2.5%), and pigments (up to 0.1%) were found in sapropel of paleoceanic sediments. Considerably smaller amounts of these compounds were found in neoeuxinic sediments and in shelf sediments laid down in oxygenated water. High concentrations of chlorophyll and pheophytin were observed in paleoceanic sediments. Accumulation and preservation of chlorophyll, pheophytin, and humic acids in Black Sea sediments depend on oxidation-reduction conditions in the water and bottom sediments, character of the sedimentary facies, lithology and particle-size distribution of the sediments, and the sedimentation rate. (Josefson-USGS) W73-11411

THE CLASSIFICATION OF ARID ZONE SOILS: I. AN APPROACH TO THE CLASSIFICATION OF ARID ZONE SOILS USING DEPOSITIONAL FEATURES, Hunting Technical Services Ltd., Boreham Wood (England).

For primary bibliographic entry see Field 02G.

W73-11417

MAJOR AND TRACE ELEMENT LOADING OF CENTRAL MICHIGAN LAKES, Michigan State Univ., East Lansing. Dept. of Geology.

For primary bibliographic entry see Field 05B.

W73-11427

ECOLOGICAL MONITORING OF TWO BEACH NOURISHMENT PROJECTS IN BROWARD COUNTY, FLORIDA, Florida Atlantic Univ., Boca Raton. Dept. of Zoology.

W. R. Courtenay, Jr., D. J. Herrema, M. J. Thompson, W. P. Azzinaro, and J. Van Montfrans. *Shore and Beach*, Vol 40, No 2, p 9-13, October 1972. 6 fig, 6 ref.

Descriptors: *Beach erosion, *Ecology, *Coastal engineering, *Dredging, *Monitoring, Excavation, Sedimentation, Shores, Benthos. Identifiers: Beach protection.

Surveys of biological communities within any area proposed for dredging and filling or beach nourishment and restoration should be included in every such project proposal. These surveys should be conducted by both competent biologists and engineering surveyors working as a team prior to any dredging activities. A report should result from these investigations which is submitted to the agency contracting the project, the agency approving the project, the engineering-surveying design group, the dredging firm, and any public agency requiring a statement of environmental impact of the proposed project. Ecological monitoring should be conducted during and after every such project by both biologists and engineers, again working as a team, to advise the dredging firm on protection of reef areas by taking advantage of adequate borrow areas, to prevent direct physical destruction of reef areas, and to assure that the initial recommendations of the survey team were carried out to the best advantage for protection of natural resources and completion of the project. In no case should dredging equipment be used in such projects which, by their design, contribute to unnecessary increases in turbidity and subsequent sediment fallout. The objective is to put the fill on the beach and not at the expense of natural nearshore and offshore resources. With proper planning and monitoring, both objectives can be met. (Knapp-USGS) W73-11528

SCOUR AND FILL IN TUJUNGA WASH—A FANHEAD VALLEY IN URBAN SOUTHERN CALIFORNIA—1969, Geological Survey, Washington, D.C.

K. M. Scott.

Available from GPO, Washington, D.C. 20402 Price \$0.70. Geological Survey Professional Paper 732-B, 1973. 29 p, 16 fig, 1 tab, 18 ref.

Descriptors: *Scour, *Sedimentation, *Alluvial fans, *Urban hydrology, *California, Alluvial channels, Erosion, Deposition (Sediments), Degradation (Stream), Aggradation, Graded, Floods, Urbanization. Identifiers: *Tujunga Wash (Calif).

In Tujunga Wash in southern California, extensive scour and fill occurred during the record-breaking 1969 floods in this 3-mile-long, partly urbanized fanhead valley. Maximums of 20 feet of net scour and 35 feet of net fill were measured. The causes of the scour and fill were (1) the unexpected yet possibly natural diversion of floodflow to a major distributary channel of the wash in which urbanization had progressed, (2) local reduction in base level which occurred when floodflow in both of the main distributary channels entered a large gravel pit, and (3) lateral scour of an aggradational surface within the wash because of natural adjustment of a distributary channel to flood discharge. Additional scour and fill were due to locally raised base level and to the natural lateral shift characteristic of channels in the broad, ephemeral washes of arid and semiarid regions. Damage at most, if not all, localities could be directly ascribed to man's disregard of natural geomorphic processes on alluvial fans and in fanhead valleys. Urban development on the unstabilized cutbank of a natural flood channel on an alluvial fan or fanhead valley is generally a poor risk. (Knapp-USGS) W73-11550

FALLING-DROP TECHNIQUE FOR SILT-CLAY SEDIMENT ANALYSIS, Wisconsin Univ., Green Bay. Coll. of Environmental Sciences. For primary bibliographic entry see Field 05A. W73-11558

Field 02—WATER CYCLE

Group 2J—Erosion and Sedimentation

SEDIMENT RECORDS OF THE SNOWY MOUNTAINS REGION, AUSTRALIA. Snowy Mountains Hydro-Electric Authority, Cooma (Australia).

June 1972. 248 p.

Descriptors: *Sediment transport, *Turbidity, *Australia, *River basins, Data collections, Suspended solids, Sediment yield, Sediment discharge, Particle size, Sampling, Reservoirs, Bed load, Hydrologic data, Streamflow, Runoff, Vegetation, Geology, Aerial photography, Mountains.

Identifiers: *Snowy Mountains Region (Australia).

All the records are presented of suspended sediment concentration and turbidity collected by the Snowy Mountains Hydro-electric Authority in the Snowy Mountains and adjacent regions of southeastern Australia during the period 1954 to June 1969. Similar records collected by the Snowy Mountains Council, the organization responsible for the operation of the Snowy Mountains Scheme, from July 1969 to December 1971, also are included. The publication is divided into two parts: Part A contains explanatory notes on the records, and Part B contains the records within the Murray River basin, Upper Murray River basin, and Snowy River basin. Summaries are given of the records in each basin. (Woodard-USGS)

W73-11572

NUMERICAL TECHNIQUES APPLIED TO PARTICLE DEPOSITION DURING SLOT FLOW, Howard Univ., Washington, D.C. Dept. of Chemical Engineering.

T. W. Copenhagen, P. B. Deshpande, and R. E. Babcock.

Water Resources Bulletin, Vol 9, No 3, p 556-566, June 1973. 10 fig, 6 ref. OWRR B-004-ARK (5).

Descriptors: *Sedimentation, *Injection wells, *Numerical analysis, *Waste disposal wells, *Hydrofracturing, Sediment transport, Mathematical models, Underground waste disposal, Deposition (Sediments), Viscosity, Particle size.

The process of particle sedimentation from a fluid-solid slurry while flowing through a vertical slot was studied using a mathematical model. The differential equations describing the process consist of a 1st order, nonlinear, partial differential equation and a 1st order, ordinary differential equation. These two equations are solved using a forward difference technique. Results for typical sets of system parameters are presented and discussed. The model has practical applications in solid-waste disposal processes and in petroleum reservoir stimulation processes. The deposited particles quickly form a trapezoidal-shaped bank. This bank then builds essentially upward, not longitudinally, until the equilibrium height of the bank is reached. At this time, the bank exists essentially as a rectangle. Continued injection causes the bank to grow longitudinally creating a right trapezoid with its axis horizontal instead of vertical. The longitudinal point at which the bank quits building upward and begins to build longitudinally has been designated as the 'pinch point.' This point represents the carrying capacity of the slurry because it is at this point that the concentration of particles of the leading slurry front becomes zero due to deposition. The slope of the concentration versus length profile appears to be linear up to this point. Small particle diameters, high viscosity, and high injection rates cause the pinch point to occur at a point far removed from the injection point. Large particle diameters, low viscosity, and small injection rates cause the pinch point to occur near the injection point. (Knapp-USGS)

W73-11697

EFFECTS OF ROADWAY AND POND CONSTRUCTION ON SEDIMENT YIELD NEAR HARRISBURG, PENNSYLVANIA, Geological Survey, Harrisburg, Pa.

L. A. Reed.

Geological Survey open-file report, August 1971. 14 p, 7 fig, 4 ref.

Descriptors: *Sediment yield, *Road construction, *Ponds, *Pennsylvania, *Sediment transport, Streams, Environmental effects, Sedimentation rates, Land development, Correlation analysis, Engineering structures, Excavation, Erosion.

Identifiers: *Harrisburg area (Penn).

The effects are shown which the construction of half a mile of one-lane roadway during June-August 1970 and construction of a 5-acre pond during August and September 1970 had on sediment concentrations and sediment discharge of a stream draining an area of 0.76 square mile near Harrisburg, Pennsylvania. The effects of the construction are shown by comparing the data collected from the affected basin with data collected from a similar adjacent basin, unaffected by construction. During the pond construction, base-flow sediment concentrations increased from 6 mg/liter to an average of 35 mg/liter. Sediment discharge during June through December 1970 attributable to the construction was 55 tons, two-thirds of the amount normally expected during a year. (Woodard-USGS)

W73-11700

2K. Chemical Processes

THE THERMAL CONDUCTIVITY OF PURE WATER AND STANDARD SEA WATER AS A FUNCTION OF PRESSURE AND TEMPERATURE: PART II—PURE WATER, Naval Ship Research and Development Center, Bethesda, Md.

V. J. Castelli, and E. M. Stanley.

Available from NTIS Springfield, Va 22151 AD-751 025 Price \$3.00 printed copy; \$0.95 microfiche. Report 3566-II, October 1972. 8 p, 5 fig, 5 tab, 11 ref.

Descriptors: Thermal conductivity, *Bodies of water, *Water temperature, *Water pressure, Correlation analysis, Analytical techniques, Measurement, Methodology, Data collections, Research equipment.

Identifiers: Pure water.

Observations were made of the thermal conductivity of pure water for the pressure range of atmospheric to 1400 bars and temperatures from 0 deg to 30 deg C. Two distinct series of measurements were conducted by utilizing different thermocouple junctions. Each series consisted of at least three determinations of each data point and many determinations of selected reference data points, primarily at 10 and 25 bars pressure. In almost all cases, the data resulting from any particular series agreed to within 0.2% of the mean value. Direct comparison of the data are tabulated. (Woodard-USGS)

W73-11084

WATER RESOURCES DATA FOR ALABAMA, 1970: PART 2. WATER QUALITY RECORDS. Geological Survey, University, Ala.

Basic-data report, 1970. 94 p, 1 fig, 2 tab, 6 ref.

Descriptors: *Water quality, *Surface waters, *Alabama, *Chemical analysis, Basic data collections, Streams, Streamflow, Flow rates, Sediment transport, Particle size, Sediment yield, Water temperature, Sampling.

Identifiers: *Water quality records (Ala).

Water quality data are presented for surface waters in Alabama for the 1970 water year. Data for a few water quality stations in bordering States are also included. Water quality information is presented for chemical quality, fluvial sediment, and water temperatures. The chemical quality includes concentrations of individual dissolved constituents and certain properties or characteristics such as hardness, sodium-absorption-ratio, specific conductance, and pH. Fluvial sediment information is given for suspended-sediment discharges and concentrations and for particle-size distribution of suspended sediment and bed material. Water temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes information from which daily minimums and maximums are obtained. (Woodard-USGS)

W73-11085

SPECTRA OF TURBULENT FLUCTUATIONS OVER OCEAN WAVES, Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 02B.

W73-11087

TRITIUM CONCENTRATION OF A VARIETY OF WATER SAMPLES: FIFTH LISTING, Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Soils.

For primary bibliographic entry see Field 05B.

W73-11104

NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY : APPENDIX H, MINERALS. Bureau of Mines, Washington, D.C.

For primary bibliographic entry see Field 03D.

W73-11107

CHARACTERISTICS AND ENVIRONMENTAL QUALITY OF SIX NORTH SHORE BAYS, NASSAU AND SUFFOLK COUNTIES, LONG ISLAND, NEW YORK, State Univ. of New York, Stony Brook. Marine Science Research Center.

M. G. Gross, D. Davies, P. M. Lin, and W. Loeffler.

Technical Report Series No 14, January 1972. 98 p, 21 fig, 20 tab, 30 ref, append.

Descriptors: *Water quality, *Bays, *New York, Environmental effects, Chemical properties, Physical properties, Surveys, Sampling, Data collections, Regression analysis, Correlation analysis, Evaluation, Classification, Ecology, Dissolved oxygen, Sediments, Drainage area, Inflow, Geology, Climate, Tidal effects, Storms, Water circulation.

Identifiers: Hempstead Harbor (N Y), Huntington Harbor (N Y), Little Neck Bay (N Y), Mt. Sinai Harbor (N Y), Port Jefferson Harbor (N Y).

Environmental studies of six bays on the north shore of Long Island provide data needed for long-range planning. Three environmental quality indicators were developed: present indicators, integrative indicators, and predictive indicators. Present indicators are based on data from the survey of water quality (e.g. dissolved oxygen). Integrative indicators are based on data from the survey of bottom deposits (e.g. loss on ignition). Predictive indicators are based on a number of factors: basic characteristics of the north shore bays (e.g. regional setting, drainage basins, geology, climate, tides, water circulation, storms); present water quality; and past water quality trends. By combining knowledge of present conditions and past trends with probable future processes, predictive indicators can be formulated. Based on present indicators the bays and harbors are ranked: (1) Manhasset Bay (worst); (2) Hempstead

WATER CYCLE—Field 02

Chemical Processes—Group 2K

Harbor; (3) Huntington Harbor; (4) Port Jefferson Harbor; (5) Little Neck Bay; and (6) Mt. Sinai Harbor (best). Based on integrative indicators the bays and harbors are ranked: (1) Manhasset Bay (worst); (2) Huntington Harbor; (3) Hempstead Harbor; (4) Little Neck Bay; (5) Port Jefferson Harbor; and; (6) Mt. Sinai Harbor (best). Based on predictive indicators the bays and harbors are ranked: (1) Huntington Harbor (worst); (2) Manhasset Bay; (3) Hempstead Harbor; (4) Mt. Sinai Harbor; (5) Port Jefferson Harbor; and; (6) Little Neck Bay (best). (See also W73-11109) (Woodard-USGS)
W73-11108

SURVEY OF WATER QUALITY AND SEDIMENTS IN SIX NORTH SHORE BAYS, NASSAU AND SUFFOLK COUNTIES, LONG ISLAND, NEW YORK (APPENDIX TO TECHNICAL REPORT NO. 14).
State Univ. of New York, Stony Brook. Marine Sciences Research Center.
M. G. Gross, D. Davies, P. M. Lin, and W. Loeffler.

Technical Report Series No 15, February 1972. 29 p, 16 fig, 4 tab, 6 ref.

Descriptors: *Water quality, *Bays, *New York, Chemical properties, Physical properties, Data collections, Sampling, Boats, Water analysis, Sediments, Chemical analysis, Analytical techniques.

Identifiers: Hempstead Harbor (N Y), Huntington Harbor (N Y), Little Neck Bay (N Y), Mt. Sinai Harbor (N Y), Port Jefferson Harbor (N Y).

This appendix presents water quality and sediment data collected in Little Neck Bay, Manhasset Bay, Hempstead Harbor, Huntington Harbor, Port Jefferson Harbor, and Mt. Sinai Harbor, New York, during the period May-December, 1971. The surveys, sponsored by the Nassau-Suffolk Regional Planning Board, were part of a project designed to establish physical and chemical criteria for assessment of environmental quality in the bays (MSRC Technical Report Series No. 14, Gross et al, 1972). Presented are the sampling procedures and analytical techniques used in the surveys. The cruises are outlined in tables. Figures indicative of the entire body of data (which is stored at the Marine Sciences Research Center) are presented. (See also W73-11108) (Woodard-USGS)
W73-11109

WATER QUALITY INVESTIGATIONS: SOURIS RIVER BASIN, NORTH DAKOTA, 1969,
Environmental Protection Agency, Kansas City, Mo. Region VII.
For primary bibliographic entry see Field 05B.
W73-11115

SURVEY OF APPLICATION OF RADIATION TO PREPARATIVE CHEMISTRY,
National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center.
W. H. Philipp.

Available from NTIS, Springfield, Va 22151 as NASA TN D-7285, Price \$3.00 printed copy: \$0.95 microfiche. Note TN D-7285, May 1973. 32 p, 5 tab, 34 ref.

Descriptors: *Radiation, *Chemical reactions, *Aqueous solutions, Synthesis, Metals, Methodology, Oxidation, Reduction (Chemical), Ionization, Irradiation, Inorganic compounds, Organic compounds, Solvents.
Identifiers: Synthetic chemical compounds.

The use of radiation for preparative chemistry in liquid solutions is outlined. General principles are presented, and preparations involving reduction, oxidation, polymerization, and decomposition are given. The use of various solvents, water, inorganic liquids, and organic liquids, is discussed.

Finally, a commentary is made on some specific applications where radiation chemistry as a preparative technique may be useful. Much of the discussion is based on extrapolation of existing radiochemical data which entails some speculation. At present, the use of radiation for this purpose is limited to the preparation of laboratory quantities of high purity materials and to the synthesis of compounds that cannot be readily prepared by ordinary chemical means. An exception is when chain or autocatalytic processes are involved which result in high energy yields of product; in this case, radiation may be used for larger production. (Woodard-USGS)
W73-11119

VOLUMETRIC DETERMINATION OF NICKEL BY HIGH FREQUENCY IMPEDIMENTRY,
Consejo Superior de Investigaciones Cientificas, Santiago (Spain). Departamento de Quimica Analitica.

For primary bibliographic entry see Field 05A.
W73-11127

ALPHA-AL203 AS AN ADSORBENT IN THIN-LAYER CHROMATOGRAPHY,
Silesian Univ., Katowice (Poland). Inst. of Chemistry.
For primary bibliographic entry see Field 05A.
W73-11128

INFLUENCE OF WEATHERING ON EFFECTIVE VALUES OF SHEAR STRENGTH OF MIocene CLAY,
J. Herust.

In: Proceedings of the 4th Budapest Conference on Soil Mechanics and Foundation Engineering, A. Kezdi, editor, October 12-15, 1971, Hungary: Academias Kiado, Budapest, p 135-142, 1971. 4 fig, 3 tab, 9 ref.

Descriptors: *Weathering, *Soil strength, *Clays, *Consolidation, Shear, Porosity, Leaching, Plasticity, Liquid limits, Mineralogy, Clay minerals, Compressive strength, Soil structure.
Identifiers: *Bohemia (Czechoslovakia).

In miocene clays from Northwest Bohemia there are four weathering zones. Analysis of the behavior in shear strength tests of clays from individual weathering zones supplemented by microscopic study of the structures demonstrates that weathering breaks up the original structures into individual aggregates of clay particles and produces fairly large pores. In weathering zone III the aggregates have been subsequently sealed with hydroxides of iron, and the behavior of the originally overconsolidated soil approximates the behavior of soils with metastable structure. Further intensive weathering in zone IV disrupts the diagenetic bonds produced by the hydroxides, and the clay behaves here like a normally consolidated or slightly overconsolidated soil. (Knapp-USGS)
W73-11126

WATER SAMPLING GUIDELINES AND INTERPRETATION OF DATA,
Environmental Health Lab., McClellan AFB, Calif.
For primary bibliographic entry see Field 07A.
W73-11205

SIMULTANEOUS TRANSPORT OF CHLORIDE AND WATER DURING INFILTRATION,
California Univ., Davis. Dept. of Water Science and Engineering.
C. Kirda, D. R. Nielsen, and J. W. Biggar.
Soil Science Society of America Proceedings, Vol 37, No 3, p 339-345, May-June 1973. 7 fig, 1 tab, 27 ref.

Descriptors: *Leaching, *Diffusion, *Chlorides, *Infiltration, Mass transfer, Convection, Dispersion, Path of pollutants, Mixing, Soil water movement, Water chemistry, Tracers, Tracking techniques, Radioisotopes.
Identifiers: Chloride transport.

Displacement of chloride during infiltration was studied using soil columns for two cases: chloride initially spread on the soil surface; and chloride initially mixed with the soil. Chloride was applied as CaCl₂ labeled with Cl-36. In conjunction with chloride activity measurement, gamma-ray attenuation measurement was used for monitoring the water content distribution during the simultaneous flow of chloride and water. Treatments included different levels of initial soil water content and different levels of water saturation at the soil surface during infiltration. The equations describing vertical water flow and miscible displacement of chloride were solved numerically. Experimental and calculated chloride distributions were in agreement. Chloride apparent diffusion coefficients estimated for pore water velocities less than 0.01 cm per min were nearly equal to those for molecular diffusion only. Initial soil water content did not influence the depth of chloride displacement for a given quantity of water infiltrated. Keeping the water content at the soil surface below saturation resulted in a deeper and more complete displacement of chloride. (Knapp-USGS)
W73-11213

WATER RESOURCES OF HEMPSTEAD, LAFAYETTE, LITTLE RIVER, MILLER, AND NEVADA COUNTIES, ARKANSAS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W73-11222

WATER ANALYSIS,
Geological Survey, Lakewood, Colo.
M. J. Fishman, and D. E. Erdmann.
Analytical Chemistry, Vol 45, No 5, p 361R-403R, April 1973. 630 ref.

Descriptors: *Metals, *Analytical techniques, *Water analysis, Analysis, Trace elements, Heavy metals, Alkali metals, Mercury, Lead, Cadmium, Gold, Silver, Nickel, Chemical analysis, Separation techniques, Sampling, Spectrophotometry, Gas chromatography, Detergents, Chromatography, Laboratory equipment, Halides, *Reviews, *Bibliographies.
Identifiers: *Atomic absorption spectroscopy.

This biennial review of methods of water analysis covers the literature from October 1970 through September 1972. Over six hundred references from major journals in the world are cited. Recent developments in the following analyses are included: alkali metals; hardness, alkaline earth metals; aluminum, iron, manganese, chromium, rhenium, cerium, and titanium; copper, zinc, lead, cadmium, nickel, cobalt, and tin; mercury, silver, and gold; vanadium, molybdenum, scandium, antimony, bismuth, uranium, and rare earths; selenium, boron, arsenic, phosphorus, and silica; and halides. Organics, sulfur and nitrogen compounds, oxygen parameters, detergents and miscellaneous determinations are covered in more detail. (Oleszkiewicz - Vanderbilt)
W73-11285

THE USE OF ATOMIC ABSORPTION FOR ANALYSIS OF NATURAL WATERS,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.
W73-11291

Field 02—WATER CYCLE

Group 2K—Chemical Processes

ATOMIC ABSORPTION SPEC-TROPHOTOMETRY AS A TOOL FOR THE WATER CHEMIST,
Calgon Corp., Pittsburgh, Pa.
For primary bibliographic entry see Field 05A.
W73-11294

DETERMINATION OF TOTAL CHROMIUM IN FRESH WATERS BY ATOMIC ABSORPTION,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.
W73-11295

DETERMINATION OF TRACE MERCURY IN SOIL AND ROCK MEDIA,
Colorado School of Mines, Golden. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W73-11297

ATOMIC ABSORPTION SPEC-TROPHOTOMETRY IN THE FIELD OF MARINE RESEARCH,
Alaska Univ., College, Inst. of Marine Science.
For primary bibliographic entry see Field 05A.
W73-11298

THE CHANGING CHEMISTRY OF THE OCEANS.
For primary bibliographic entry see Field 05B.
W73-11367

NITROUS OXIDE IN AIR AND SEA WATER OVER THE ATLANTIC OCEAN,
Max-Planck-Institut fuer Chemie, Mainz (West Germany).
For primary bibliographic entry see Field 05B.
W73-11370

IMPACT OF NATURAL AND MAN-MADE SURFACE FILMS ON THE PROPERTIES OF THE AIR-SEA INTERFACE,
Naval Research Lab., Washington, D.C. Ocean Science Div.
For primary bibliographic entry see Field 05B.
W73-11371

SOME ASPECTS OF THE GEOCHEMISTRY OF MARINE AEROSOLS,
Centre National de la Recherche Scientifique, Gif-sur-Yvette (France). Centre des Faibles Radioactivities.

R. Chesselet, J. Morelli, and P. B. Menard.
In: **The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden:** Wiley Interscience Division of John Wiley and Sons, Inc., p 93-114, 1972. 13 fig, 3 tab, 71 ref.

Descriptors: *Aerosols, *Water chemistry, *Sea water, *Sea spray, Sodium, Chlorides, Hydrologic cycle, Potassium, Magnesium, Calcium.
Identifiers: *Marine aerosols.

A considerable proportion of the salts dissolved in rivers has a marine origin. These salts arise from the injection of particles into the atmosphere at the surface of the oceans; they fall out, subsequently, onto the continents, and are then carried back to the oceans by rivers. The relative proportions of the principal ionic constituents in seawater are never found in the atmosphere or in precipitations. The weight ratios between chlorine, sodium, potassium, and calcium seem to reflect an enrichment process for potassium and calcium, with respect to sodium. The source of gaseous chlorine in the atmosphere is the release above the ocean of gaseous chlorine, probably as HCl, at the expense of particulate chlorine. Concentrations of gaseous chlorine of marine origin above the lands seem to

be controlled by a slow combination of this chlorine with the terrigenous environment. This loss balances a supply of oceanic gaseous chlorine of about 200 million tons per year. (See also W73-11367) (Knapp-USGS)
W73-11372

THE ROLE OF THE OCEANS AND BIOSPHERE IN THE CARBON DIOXIDE CYCLE,
National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
L. Machta.

In: **The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden:** Wiley Interscience Division of John Wiley and Sons, Inc., p 121-145, 1972. 7 fig, 8 tab, 12 ref, append.

Descriptors: *Carbon dioxide, *Water chemistry, *Climatology, *Carbon cycle, Sea water, Tracers, Carbon radioisotopes, Carbonates, Oceans.
Identifiers: *Carbon dioxide cycle.

Carbon dioxide plays a role in the radiation budget of the atmosphere. The fluctuations of this gas, due either to natural or manmade causes, must be predicted and understood before forecasts of climate modification can be undertaken. The three reservoirs through which carbon exchanges are the atmosphere, the biosphere, and the oceans. Prediction of atmospheric carbon dioxide depends on the input of carbon dioxide from the combustion of fossil fuels, the exchange between reservoirs, the exchanges within parts of each reservoir, and the stability of each reservoir. Despite uncertainties in the true seasonal variation of biospheric uptake and release of carbon dioxide to the atmosphere, the biosphere is dominant in seasonal variation. The oceans have a smaller effect even in the southern hemisphere with its large water area. In fact, the oceans, if important for this purpose, would produce the opposite changes in atmospheric carbon dioxide from those observed, because of seasonal temperature variations. The reasons for the lesser role of the oceans may be slow response time to temperature changes and the compensating effects of the marine biosphere. (See also W73-11367) (Knapp-USGS)
W73-11373

THE CHEMICAL STABILITY OF THE OCEANS AND THE CO₂ SYSTEM,
Oregon State Univ., Corvallis. Dept. of Oceanography.

R. M. Pytkowicz.
In: **The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden:** Wiley Interscience Division of John Wiley and Sons, Inc., p 147-152, 1972. 2 fig, 8 ref. NSF Grant GA-17011.

Descriptors: *Water chemistry, *Sea water, *Equilibrium, *Kinetics, Carbon dioxide, Hydrogen ion concentration, Chemical reactions, Chemical potential.
Identifiers: *Steady-state chemistry.

As an alternative mechanism to equilibrium for chemical stability of ocean water, the steady state is reasonable in stationary open systems with gradients of chemical potential. Equilibria and steady states may coexist in the oceans. Steady states require only that the net input and output rates of reservoirs be equal and are, therefore, less restrictive than equilibria for which the net rates must be zero. Simple first order models are used to deduce the general conditions which lead to an equilibrium or to a steady state ocean and to suggest more complex models and the types of data needed to treat geochemical systems quantitatively. A steady state ocean will occur in chemical systems in which the weathering reservoir on land is not seriously depleted within the time scale of interest, whether the systems in the oceans are controlled by biological or by mineral equilibration

processes. Dissolved CaCO₃ is not at equilibrium with the solid phase, and the removal of alkalinity is biogenic. Therefore, the alkalinity of the oceans appears to be in steady state. The pCO₂ of seawater below the thin wind mixed layer is controlled by oxidation rather than by near equilibrium with the atmosphere. The pH is determined by any two relevant quantities. Thus, if the alkalinity and the pCO₂ of seawater are at a steady state controlled by life processes, then so is the pH. (See also W73-11367) (Knapp-USGS)
W73-11374

MICROBIAL ACTIVITY AS A BIOGEOCHEMICAL FACTOR IN THE OCEAN,
Akademiya Nauk SSSR, Yaroslavl. Institut Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 05B.
W73-11378

ON THE AGE OF STABLE ORGANIC MATTER-AQUATIC HUMUS IN OCEANIC WATERS,
Akademiya Nauk SSSR, Yaroslavl. Institut Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 05B.
W73-11379

CHEMICAL CYCLES WITH ENERGY CIRCUIT MODELS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 02A.
W73-11381

GEOLOGICAL, GEOCHEMICAL AND ENVIRONMENTAL IMPLICATIONS OF THE MARINE DUST VEIL,
Liverpool Univ. (England). Dept. of Oceanography.
For primary bibliographic entry see Field 05B.
W73-11383

MANGANESE NODULES AND BUDGET OF TRACE SOLUBLES IN OCEANS,
Tata Inst. of Fundamental Research, Bombay (India).
For primary bibliographic entry see Field 05B.
W73-11384

SULFATE REDUCTION, PYRITE FORMATION, AND THE OCEANIC SULFUR BUDGET,
Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 05B.
W73-11386

CALCITE SATURATION IN AN EASTERN KENTUCKY KARST STREAM,
Kentucky Univ., Lexington. Dept. of Geology.
D. P. Beiter.
M Sc Thesis, 1970. 75 p, 12 fig, 6 tab, 5 append. OWRR A-009-KY (3).

Descriptors: *Limestones, *Sedimentary rocks, *Calcite, *Kentucky, Water quality, *Groundwater, Caves, Streams, Sampling, Water Chemistry, Chemical analysis, Karst, Dissolved solids, Analytical techniques.
Identifiers: Dissolved calcite.

Meteoric water entering a body of limestone is capable of dissolving appreciable amounts of rock over long periods of time. Since in many limestone bodies, the only available water supply is from openings produced by solution, it is of interest to know the location and rate of such solution. One approach is to determine the capability of the water at any point to further dissolve calcite, the main constituent of limestone. Cave Hollow is a

hanging karst valley in Lee County, Kentucky, approximately halfway between Irvine and Beattyville. The caves of the Cave Hollow System are excavated in Mississippian limestone which is overlain by Pennsylvanian shales and sandstones, and underlain by Mississippian siltstones and shales. The entire valley is about 2.6 km long and 1.2 km wide and is floored by the limestone. Local relief is about 150 m. Streams heading on the Pennsylvanian clastics flow towards the limestone and sink near the contact. All water emerges from a spring near the mouth of the valley. Samples were collected at various points of the Cave Hollow System between March and December 1968. Two types of conclusions were made from the study. First are those concerning the chemistry of the system. Second are those concerning the methods and the directions of needed future inquiry. (Woodard-USGS)
W73-11391

WATER RECORDS OF THE U.S. VIRGIN ISLANDS, 1962-69.
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W73-11396

GROUND-WATER BASIC DATA OF CAVALIER AND PEMBINA COUNTIES,
Geological Survey, Bismarck, N. Dak.
For primary bibliographic entry see Field 04B.
W73-11397

HYDROLOGIC RECORDS FOR VOLUSIA COUNTY, FLORIDA: 1971-72.
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 07C.
W73-11399

ROLE OF IRON SULFIDES IN THE ACCUMULATION OF TRACE ELEMENTS IN BLACK SEA SEDIMENTS (ROL' SUL'FIDOV ZHELEZA PRI NAKOPLENII MIKROELEMENTOV V OSADKAKH CHERNOGO MORYA),
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W73-11409

SOME PROBLEMS IN THE GEOCHEMISTRY OF MOLYBDENUM IN THE MEDITERRANEAN SEA (NEKOTORYE VOPROSY GEOKHIMII MOLIBDENA V SREDIZEMNOM MORE),
Akademiya Nauk SSSR, Gelendzhik. Institut Okeanologii.
M. F. Pilipchuk.
Litologiya i Poleznye Iskopayemye, No 2, p 25-31, March-April 1972. 3 fig, 2 tab, 17 ref.

Descriptors: *Geochemistry, *Sea water, *Molybdenum, Trace elements, Metals, Sediments, Silts, Organic matter, Inorganic compounds, Pyrite, Chemical reactions, Analytical techniques, Sampling, Cores.
Identifiers: USSR, *Mediterranean Sea, Sea of Marmara, Organic carbon, Vanadium, Tungsten.

The Mo content in the eastern part of the Mediterranean Sea is high, amounting to 10.9-17.7 micrograms of Mo/liter. The vertical distribution of Mo in the sea water is uniform and is typical of other normally aerated basins. In the Sea of Marmara, the slight decrease in Mo concentration in the surface layer is due to the influence of fresh Black Sea waters, and the Mo concentration in the sediments varies between 0.0001% and 0.0080%. In sediments with an oxygen regime, maximum Mo concentrations are confined to layers rich in manganese hydroxide. There is a clear correlation between Mo and organic carbon in the reduced sediments. (Josephson-USGS)
W73-11410

CONDITIONS OF PRESERVATION OF CHLOROPHYLL, PHEOPHYTIN, AND HUMIC SUBSTANCES IN BLACK SEA SEDIMENTS (USLOVIYA SOKHRANNOSTI KHLOROFILA, FEOFITINA I GUMINOVYKH VESHCHESTV V OTLOZHENIYAKH CHERNOGO MORYA),
Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimii.

For primary bibliographic entry see Field 02J.
W73-11411

DISTRIBUTION AND COMPOSITION OF MINERAL WATER IN THE TUVA AUTONOMOUS REPUBLIC (ZAKONOMERNOSTI RASPROSTRANENIYA I SOSTAV PODzemnykh MINERAL'NYKH VOD TUVY),
Institut Zemnoi Kory, Irkutsk (USSR).
For primary bibliographic entry see Field 02F.
W73-11412

DISTRIBUTION OF TRACE ELEMENTS IN BODIES OF WATER OF KAZAKHSTAN (RASPREDELLENIE MIKROELEMENTOV V VODOYEMAKH KAZAKHSTANA),
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Khimicheskikh Nauk.
A. I. Mun, and A. B. Bekturow.
Izdatel'stvo 'Nauka' Kazakhskoy SSR, Alma-Ata, 1971. 290 p.

Descriptors: *Geochemistry, *Trace elements, Bodies of water, *Lakes, Saline lakes, Rivers, Springs, Groundwater, Freshwater, Lake sediments, Bottom sediments, Halogens, Metals, Boron, Brines, Salinity, Ions, Humic acids, Water chemistry, Water sampling.
Identifiers: *USSR (Kazakhstan), Lithium, Rubidium, Oozes, Sapropel.

Data are presented on the distribution of trace elements in water and bottom sediments of lakes in Kazakhstan. The trace elements examined are I, Br, F, B, Li, K, Rb, Cs, Co, Ni, Cu, and Zn. Brines and surface waters in northern, central and southeastern regions of the Republic are described, and attention is given to the use of certain trace elements as indicators of the salinity of water bodies. (Josephson-USGS)
W73-11413

GROUND-WATER QUALITY IN WISCONSIN THROUGH 1972,
Geological Survey, Madison, Wis.
For primary bibliographic entry see Field 02F.
W73-11568

2L Estuaries

DIRECT DETERMINATION OF THE ELECTROMAGNETIC REFLECTION PROPERTIES OF SMOOTH BRACKISH WATER TO THE CONTINUOUS SPECTRUM FROM 100 MILLION TO 4 BILLION HERTZ,
Hawaii Univ., Honolulu. Water Resources Research Center.
L. K. Lepley, and W. M. Adams.
Available from the National Technical Information Service as PB-221 372, \$4.85 in paper copy, \$0.95 in microfiche. Technical Report No 48, May 1971. 86 p, 29 fig, 50 ref, append. OWRR-B-013-HI (5).

Descriptors: *Remote sensing, Radio waves, Microwaves, *Brackish water, *Electromagnetic waves, *Salinity, Pollutants, Estuaries, *Hawaii, Springs, Roughness (Hydraulic), Reflectance, Radar, Waves, Chlorinity, Dispersion.

Computer-generated frequency dispersion curves were constructed of (1) the dielectric coefficients, (2) power reflectance, (3) brightness temperature, and (4) skin depth of water as a function of eight different normalities of sodium chloride cor-

responding to a salinity range from pure to ocean water, and as a function of five different temperatures from 0°C to 40°C to the radio frequency range from 1,000,000 to 3 x 10 to the 10th power Hertz. These graphs indicate that the frequency dispersion of the reflectance of radio energy in the 1,000,000 to 10 to the 9th power Hertz band at normal incidence to a smooth water surface is strongly influenced by the salinity of the water, and that the spectral signature could be used as a measure of water salinity as distinguished from water temperature. Reflectance spectra from 2.5 x 10 to the 9th power to 4.0 x 10 to the 9th power Hertz of fresh and sea water were obtained with a free-wave (horn antenna and pool) system and reflectance spectra of brackish and sea water from 10 to the 8th power to 2.0 x 10 to the 9th power Hertz and of fresh water from 0.8 x 10 to the 9th power to 2 x 10 to the 9th power Hertz were obtained with a coaxial waveguide system. The measured spectral signatures appear to agree with the computed reflectance of aqueous sodium chloride solutions. The theoretical and experimental results indicate that free-wave radio reflectance spectrometry from 1,000,000 to 10 to the 9th power Hertz is feasible for use in remote sensing of salinity of fresh and brackish water outflows onto sea water.
W73-11052

A CATALOG OF HYDROCLIMATOLOGICAL DATA FOR ALASKA'S COASTAL ZONE,
Alaska University, College. Inst. of Water Resources.
For primary bibliographic entry see Field 02B.
W73-11056

COASTAL DYNAMICS ALONG MUSTANG ISLAND, TEXAS,
Western Michigan Univ., Kalamazoo.
R. A. Davis, Jr., and W. T. Fox.
Available from NTIS, Springfield, Va. 22151 AD-750 756; Price \$3.00 printed copy; \$0.95 microfiche. Technical Report No 9, October 1, 1972. 68 p, 29 fig, 14 ref, append. ONR Contract N00014-69-C-0151.

Descriptors: *Hydrodynamics, *Coasts, *Islands, *Gulf of Mexico, *Texas, Beach erosion, Shores, Data collections, Shore protection, Topography, Winds, Velocity, Ocean waves, Currents (Water), Storms, Sand bars, Correlation analysis, Lake Michigan, Environmental effects, Time series analysis.
Identifiers: Mustang Island (Tex).

Two modified time-series studies were conducted along the Mustang Island, Texas coast during October-November, 1971 and January-February, 1972. Patterns exhibited by variations in monitored environmental variables show interrelationships that are quite comparable to those observed in eastern Lake Michigan. The dominating factor in controlling coastal processes along the Texas coast is barometric pressure. Large-scale fluctuations occur as cold fronts ('northerns') move through the area in an offshore direction. Changes in wind direction and velocity, breaker height, and longshore current direction and velocity accompany the passage of these fronts. The responses of beach and nearshore topography to these changes are also much like those observed in Lake Michigan. High energy conditions created by the passage of fronts cause seaward displacement and planation of the sand bar, whereas quiescent conditions permit slow shoreward migration and buildup of the sand bar. Rip currents are commonly present and may cut channels in the sand bar; however, changes in bar location and form do not show the cyclic pattern observed in Lake Michigan. (Woodard-USGS)
W73-11081

Field 02—WATER CYCLE

Group 2L—Estuaries

A CASE HISTORY OF SANTA CRUZ HARBOR, CALIFORNIA,
California Univ., Berkeley. Coll. of Engineering.
For primary bibliographic entry see Field 08B.
W73-11092

CHARACTERISTICS AND ENVIRONMENTAL QUALITY OF SIX NORTH SHORE BAYS, NASSAU AND SUFFOLK COUNTIES, LONG ISLAND, NEW YORK,
State Univ. of New York, Stony Brook. Marine Science Research Center.
For primary bibliographic entry see Field 02K.
W73-11108

SURVEY OF WATER QUALITY AND SEDIMENTS IN SIX NORTH SHORE BAYS, NASSAU AND SUFFOLK COUNTIES, LONG ISLAND, NEW YORK (APPENDIX TO TECHNICAL REPORT NO. 14),
State Univ. of New York, Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 02K.
W73-11109

HYDROGRAPHIC STUDY OF THE SHELF AND SLOPE WATERS OF NEW YORK BIGHT,
State Univ. of New York, Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 02E.
W73-11110

PHOSPHATE IN INTERSTITIAL WATERS OF ANOXIC SEDIMENTS: OXIDATION EFFECTS DURING SAMPLING PROCEDURE,
John Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.
For primary bibliographic entry see Field 05B.
W73-11118

HYDRAULIC MODEL MEASUREMENTS OF TIDAL CURRENTS AROUND CAPE HENLOPEN, DELAWARE,
Delaware Univ., Newark. Coll. of Marine Studies.
B. T. Lakshman and F. E. Camfield.
Available from NTIS, Springfield, Va 22151 AD-752 478; Price \$3.00 printed copy; \$0.95 microfiche. Technical Report No 15, July 1972. 79 p, 10 fig, 5 tab, 27 ref, append. ONR-GP Contract N00014-69-A0407.

Descriptors: *Deposition (Sediments), *Shoals, *Coasts, *Sediment transport, *Delaware. Model studies, Tidal effects, Channel morphology, Harbors, Correlation analysis, Ocean currents, Tides. Identifiers: *Cape Henlopen (Del).

Cape Henlopen, Delaware, is advancing to the north and west at the rate of approximately 12 ft per year. A harbor developed in the Cape Henlopen area in the early 1800's has since shoaled with sediment moved by currents. A study was made to investigate the feasibility of using a hydraulic model for measuring tidal currents around Cape Henlopen. The model 4 ft x 4 1/2 ft reproduced an area of about 23.2 square miles. A rocking tray constructed for the study is described. A separate open channel experiment was conducted for simulating bottom roughness through friction elements. A comparative study between measured model currents and prototype currents shows that a small-scale distorted hydraulic model can be used for measuring tidal currents. The model measurements of tidal currents indicate the possible reasons for shoaling of Breakwater Harbor and the advance of Cape Henlopen. (Woodard-USGS)
W73-11203

VOLCANIC EXHALATIONS AND METAL ENRICHMENTS AT MATUPI HARBOR, NEW BRITAIN, T.P.N.G.,
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Bass-Backing Geological Lab.
For primary bibliographic entry see Field 05B.
W73-11292

RESEARCH AND THE PROBLEMS OF TWO SEAS,

P. G. Sly.
In: Oceans Ontario. Technical Sessions. April 22, 1972, James Allister MacInnes Foundation, Toronto, Ontario, Canada. p 1-15, (1972).

Descriptors: *Bays, Hydrography, *Bathymetry, Temperature, *Salinity, *Mixing, *Diffusion, *Ice, Environmental effects, Exploitation, Oil industry, Mineral industry, Gases, Fish, Waste disposal, Dredging, Erosion, Landfills.
Identifiers: *James Bay, *Hudson Bay.

The physical conditions of the James and Hudson bays are described. Both bays are in good condition, warmer waters reflect seasonal warming in shallow areas, low salinities nearshore reflect river inflow, and oxygen levels are indicative of the mixing and diffusion expected from the bathymetry of the bays. Ice conditions were examined. The possible effects of the following are discussed: oil, gas, mineral, and fish exploitation; waste disposal; dredging; erosion; shore construction; fill operations; and thermal pollution. (Ensign-PAI)
W73-11350

A WATER-QUALITY SIMULATION MODEL FOR WELL MIXED ESTUARIES AND COASTAL SEAS: VOL. V, JAMAICA BAY RAINSTORMS,
New York City-Rand Inst., N.Y.
For primary bibliographic entry see Field 05B.
W73-11351

THE CHANGING CHEMISTRY OF THE OCEANS.

For primary bibliographic entry see Field 05B.
W73-11367

A STUDY OF COASTAL WATER QUALITY IN THE VICINITY OF SAN JUAN, PUERTO RICO, JANUARY 13-31, 1971.

Environmental Protection Agency, Athens, Ga. Southeast Water Lab.
For primary bibliographic entry see Field 05B.
W73-11388

THE USE OF MODERN CHROMIUM ACCUMULATIONS TO DETERMINE ESTUARINE SEDIMENTATION RATES,
New Hampshire Univ., Durham. Jackson Estuarine Lab.
J. M. Capuzzo, and F. E. Anderson.
Marine Geology, Vol 14, No 3, p 225-235, March 1973. 4 fig, 1 tab, 29 ref.

Descriptors: *Sedimentation rates, *Estuaries, *Chromium, *Tracers, *New Hampshire, Sedimentation, Sampling, Chemical analysis, Path of pollutants, Industrial wastes, Tannery wastes, Organic matter.
Identifiers: Great Bay estuary (NH).

To estimate the sedimentation rate and effect of chromium pollution in the Great Bay estuary of New Hampshire, cores were taken and analyzed for chromium content, size fractions, and combustible matter. These values were correlated to distinguish between natural and artificial or enhanced levels of chromium. The results indicate that chromium is accumulating in higher than natu-

ral levels in the upper reaches of the estuary and may be used as an indicator species to estimate sedimentation rates. (Knapp-USGS)
W73-11392

VOLUME TRANSPORT, SALINITY DISTRIBUTION AND NET CIRCULATION IN THE DUPLIN ESTUARY, GEORGIA,

Georgia Univ., Sapelo Island. Marine Inst. B. Kjerfve.
Available from National Technical Information Service as PB-221 535, \$3.00 in paper copy, \$0.95 in microfiche. Environmental Resources Center, Georgia Institute of Technology Report ERC-0273, April 1973, 30 p, 22 fig, 10 ref. OWRR B-035-GA (2), 14-01-0001-1892.

Descriptors: *Estuaries, *Salinity, Salt Marshes, *Georgia, *Water circulation, *Tidal waters, Saline water intrusion.
Identifiers: *Duplin River estuary (Geo.), Volume flow.

A field study during one tidal cycle in the Duplin River estuary, Georgia indicated a net up-river volume transport. It is thought that some of the Duplin water, which during high tides floods the surrounding marsh, drained off to nearby creeks when the tide falls. There is no apparent source of fresh-water along the river, yet the salinity distribution in a longitudinal section is found to decrease toward the head. The cause is believed to be ground water entering the river. Although the longitudinal net salt distribution matches the Chesapeake Bay estuaries, the lateral distribution is opposite. The time-averaged velocity data indicate a complex circulation. The longitudinal net flow across one cross section was two-layered in the middle but one- and three-layered along the eastern and western sides, respectively. (James-Georgia)
W73-11425

THE EFFECTS OF DITCHING ON THE MOSQUITO POPULATIONS IN SOME SECTION OF JUNCUS SALT MARSH IN CARTERET COUNTY, NORTH CAROLINA,
North Carolina State Univ., Raleigh. Dept. of Entomology.
For primary bibliographic entry see Field 04A.
W73-11431

LIVING FORAMINIFERIDS OF TIDAL MARSHES: A REVIEW,
Bristol Univ. (England). Dept. of Geology.
J. W. Murray.
J. Foraminiferal Res. Vol 1, No 4, p 153-161. 1971. Illus.
Identifiers: *Foraminiferids, Marshes, Miliolina, *Reviews, Rotalina, Textularina, *Tidal marshes.

Tidal marshes can be differentiated according to their water characteristics: hypersaline, normal marine, hypersaline. The living foraminiferid assemblages of all marshes have very low diversity. Hyposaline marshes have high Textularina, some Rotalina and generally an absence of Miliolina. Normal marine and hypersaline marshes are characterized by the presence of all 3 suborders. The principal species are cosmopolitan. Marsh assemblages are readily separated from those of lagoons and shelf seas.—Copyright 1972, Biological Abstracts, Inc.
W73-11502

SEISMIC SEICHES IN BAYS, CHANNELS, AND ESTUARIES,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 02H.
W73-11532

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Saline Water Conversion—Group 3A

PLANT COMMUNITIES OF WET GROUND IN NORTHEAST CHESHIRE, ENGLAND,
Michigan State Univ., East Lansing. Dept. of Botany.
B. Moss.
Vegetatio. Vol 22, No 6, p 373-385. 1971. Illus.
Identifiers: Cardamine-Flexuosa-D, Deschampsia-Cespitosa-M, *England (Cheshire), Galium-Palustre-D, Holcus-Lanatus-M, *Juncus-Effusus-M, *Plant communities, Soils, Vegetation, Wet ground, *Marshes.

Areas of impeded drainage are dominated by *Juncus effusus* marshes usually with *Cardamine flexuosa*, *Galium palustre*, *Holcus lanatus* and *Deschampsia cespitosa*. Soils and vegetational history are discussed.—Copyright 1972, Biological Abstracts, Inc.
W73-11552

SAND MOVEMENT ALONG CARMEL RIVER STATE BEACH, CARMEL, CALIFORNIA,
Naval Postgraduate School, Monterey, Calif.

B. F. Howell.

Available from NTIS, Springfield, Va. 22151 as AD-753 623, Price \$3.00 printed copy; \$0.95 microfiche. M Sc Thesis, September 1972. 67 p, 17 fig, 1 tab, 25 ref, 2 append.

Descriptors: *Sediment transport, *Beach erosion, *Littoral drift, *Bays, *California, Sediments, Sands, Particulate size, Analytical techniques, Estuaries, Sedimentology, Coasts, Ocean waves, Tidal effects, River flow, Inflow.
Identifiers: *Carmel River State Beach (Calif.).

The direction of sand movement along the Carmel River State Beach in California was qualitatively determined by diving observations, a bathymetric survey, wave refraction diagrams and a sediment size analysis of 18 samples. The primary source of sediments for the beach appears to be the Carmel River which flows only seasonally. Sedimentary material is introduced into the bay after winter precipitation provides a sufficient amount of runoff to warrant the opening of the river mouth by bulldozer. The fine sedimentary material is lost offshore and the coarser material is either redeposited on the beach or is carried south with the littoral drift and deposited at a nodal point in the sand transport pattern. This node is located on the northern edge of the head of the Carmel Submarine Canyon. Winter storms probably induce slumping or gravity sliding and much of the material is carried to deeper water by the canyon. (Woodard-USGS)
W73-11557

SAND TRANSPORT BY THE EEL RIVER AND ITS EFFECT ON NEARBY BEACHES,
Geological Survey, Menlo Park, Calif.

J. R. Ritter.

Geological Survey Water Resources open-file report, 1972. 17 p, 6 fig, 4 tab, 20 ref.

Descriptors: *Sediment transport, *Sands, *Sediment deposition, *Beaches, *California, Data collections, Estuaries, Rivers, Streamflow, Sediment yield, Discharge (Water), Sediments, Particle size. Identifiers: *Eel River (Calif), Heavy minerals.

The Eel River basin in California has one of the largest sediment yields per unit area in the world. Sand composes about 25% of the total sediment transported by the river into its estuary. The annual sand load averages about 4,600,000 tons, equivalent to a deposition of about 2,100 acre-feet of sand per year. Most of this sand enters the ocean; some is deposited in the estuary. The amount furnished to nearby beaches is small. The major part of the sand and finer sediment debouched by the Eel River into the ocean is scattered over the continental margin, some is trapped by the Eel Canyon, and some is deposited offshore near the Eel River mouth. The Eel probably sup-

plies most of the sand found along the beaches between Centerville Beach and the entrance to Humboldt Bay. The Mad and Little Rivers supply most of the sand found along the beaches between the entrance to Humboldt Bay and Moonstone Beach. Sand is defined as sediment having an intermediate diameter of 0.062-2.0 mm. Results provide an insight to the possible consequences to the coast if the sand being discharged by the Eel River is interrupted by works of man, such as a dam on its lower reaches or dredging operations at its mouth. (Woodard-USGS)
W73-11559

MEASUREMENT OF SALT-WEDGE EXCURSION DISTANCE IN THE DUWAMISH RIVER ESTUARY, SEATTLE, WASHINGTON, BY MEANS OF THE DISSOLVED-OXYGEN GRADIENT,

Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W73-11564

THE SEASONAL CYCLE OF VITAMIN B12 IN THE STRAIT OF GEORGIA, BRITISH COLUMBIA,

British Columbia Univ., Vancouver. Inst. of Oceanography.

S. A. Cattell.
Journal of the Fisheries Research Board of Canada, Vol 30, No 2, p 215-222, February 1973. 2 fig, 3 tab, 29 ref.

Descriptors: *Bioassay, *Seasonal, *Cycling nutrients, *Phosphates, *Nitrates, *Distribution patterns, Nutrients, Vitamin B, Sampling, Water analysis, Nitrites, Depth, Salinity, Cultures, Growth rates, Water temperature, Marine algae, Pyrophyta, Dinoflagellates, Phytoplankton, Estuarine environment.

Identifiers: *Vitamin B-12, *Amphidinium carterae, Strait of Georgia, Juan de Fuca Strait, Sample preparation, Particulate matter, Coulter counter.

Water samples were collected from four stations in the Strait of Georgia, British Columbia and one station in the water connecting the Strait of Georgia and Juan de Fuca Strait over a period of 17 months for use in investigating the seasonal cycle of vitamin B12. Samples were filtered and frozen in polyethylene containers for analysis of phosphate, nitrate-nitrite nitrogen and vitamin B12. Salinity and temperature were also determined for each sample. Vitamin B12 was determined by bioassay using *Amphidinium carterae*. After culturing for 11 or 12 days, bioassay samples were diluted and counted on a Model B Coulter Counter. The final yield of cell numbers was found with control solutions to be linearly related to vitamin B12 concentrations of at least 10 mg/liter. The results show that monthly averages for B12 in the upper 10 m of the Strait of Georgia are similar in temporal distribution to those of the inorganic nutrients including a winter high followed by an early spring decrease and a slight peak in late spring. However, B12 showed a peak in the summer while inorganic nutrients were at minimal concentrations. Furthermore, inorganic nutrients tended to increase with depth and correlated with water density. B12, however, showed little correlation with this parameter, even with summer stratification. It is concluded that the temporal and spatial distribution of B12 in the Strait is more complex than that of nitrate and phosphate. It is hypothesized that the observed heterogeneity of B12 is largely a result of interactions of vitamin particulate matter. (Little-Battelle)

W73-11578

NUTRIENT INVERSIONS IN THE SOUTHEASTERN TROPICAL PACIFIC OCEAN,
Scripps Institution of Oceanography, La Jolla, Calif.

W. H. Thomas.

Fishery Bulletin, Vol 70, No 3, p 929-932, 1972. 3 fig, 11 ref.

Descriptors: *Pacific Ocean, *Nitrates, *Phosphates, *Nitrites, *Silicates, Salinity, Depth, Phytoplankton, Chlorophyll, Water analysis, Sea water, Nutrients, Distribution patterns, Withdrawal.

Identifiers: *Nutrient inversion.

During a cruise of the Pacific Ocean in 1970, samples of seawater were collected at various depths in Nansen bottles for analysis of nitrates, nitrites, phosphates, and silicates. Plots of nutrient concentration versus depth showed that at a typical station nutrients such as nitrate and phosphate were high at the surface, at a minimum at about 100 m depth, and then increased at greater depths. Silicate followed this distribution to a lesser degree. These inversions occurred from lat 8 to 15 degrees S and were more pronounced in sections along long 126 degrees W and 119 degrees W than in sections farther east. The nutrient minimum was associated with water having a salinity maximum. It is suggested that such water may have acquired its characteristics in the mixed layer in areas to the south or southeast where the nutrients were depleted by phytoplankton, and had then sunk back high-nutrient and relatively fresh water carried westward from the Peru Current. However, the nutrients may also have been depleted in situ since the low-nutrient water contained a maximum amount of chlorophyll. (Little-Battelle)
W73-11587

OXYGEN DEFICIENT CONDITIONS AND NITRATE REDUCTION IN THE EASTERN TROPICAL NORTH PACIFIC OCEAN,
Washington Univ., Seattle. Dept. of Oceanography.

For primary bibliographic entry see Field 05A.
W73-11589

PHYSICAL-CHEMICAL OCEANOGRAPHIC DATA FROM THE NORTH PACIFIC OCEAN AND BERING SEA, 1971,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.

For primary bibliographic entry see Field 05A.
W73-11595

TROPHICAL ROLE OF BACTERIA IN THE ECOSYSTEM OF THE CORAL REEF,
Akademiya Nauk SSSR, Yaroslavl. Institut Biologii Vnutrennykh Vod.

For primary bibliographic entry see Field 05A.
W73-11632

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

THE MECHANISM OF FORMATION OF 'SKINNED' TYPE MEMBRANES AND THEIR CHARACTERIZATION,
Hydronautics, Inc., Laurel, Md.

M. A. Frommer, and R. Matz.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price \$1.25. Office of Saline Water Research and Development Progress Report No 774, May 1972. 125 p, 14 tab, 39 fig, 88 ref. 14-30-2529.

Descriptors: *Reverse osmosis, *Desalination, *Membranes, *Membrane processes.
Identifiers: *Cellulose acetate, Skinned membranes, Asymmetric membranes, Water flux, Salt rejection, Membrane formation, Membrane morphology, Membrane characterization.

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

This final technical report consists of a set of publications and preprints summarizing the most recent experimental observations not yet reported in the open scientific literature. Reflecting different aspects of the problems, these publications exhibit some diversity, and different degrees of refinement of approach. It is believed that these publications will make it possible to achieve a more meaningful and useful understanding of the complex phenomena involved in the preparation and characterization of skinned asymmetric membranes. The report describes an apparatus for studying the mechanism of skinned membrane formation, membrane structures and their relation to preparation conditions, and a theory of the mechanisms by which skinned membranes form. (OSW) W73-11153

RESEARCH ON PIEZODIALYSIS, THIRD REPORT,

Ionic Inc., Watertown, Mass.

F. B. Leitz, and J. Sharf.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price \$0.75. Office of Saline Water Research and Development Progress Report No 775, May 1972. 80 p, 22 fig, 17 tab, 22 ref. 14-01-0001-2333.

Descriptors: *Desalination, *Membrane processes, *Dialysis, *Permeable membranes. Identifiers: *Piezodialysis, *Charge-mosaic membranes, Ion-exchange resins.

Piezodialysis is a new and promising process for water desalination. In this process a concentrated salt solution passes through a membrane leaving a stream of reduced salinity. Based on irreversible thermodynamics, a mathematical description of the process has been obtained which, using the transport properties of the resins of which the membrane is composed, predicts the kind of performance which might be obtained. Strong coupling between the counterions and the gel water in the resins is required. Several ion-exchange resins have been developed which have adequate coupling between counterions and water. A variety of techniques have been investigated for using these resins in composite membranes, some of which have shown significant salt enrichments. A laboratory piezodialysis module which has given useful desalinations is described. (OSW) W73-11154

TUBE IDENTIFIER,

Oak Ridge National Lab., Tenn.

H. W. Hoffman, and L. G. Alexander.

Available from the National Technical Information Service as ORNL-TM-2713 (rev 1), \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No 796, October 1971. 36 p, 2 tab. 14-30-2535 W.O. 7.

Descriptors: *Boiling, *Dropwise condensation, Condensation, Evaporation, *Heat transfer, *Distillation, *Evaporators, *Films, Porous media, *Tubes. Identifiers: VTC heat transfer surfaces, Evaporator-condenser tubes, Doubly fluted tubes, Corrugated tubes, Porous-surfaced tubes.

This volume provides a physical description of the evaporator-condenser tubes examined at the Oak Ridge National Laboratory under the Office of Saline Water program on Advanced VTE Heat Transfer Surfaces. (OSW) W73-11155

THE GROWTH RATE OF ICE CRYSTALS: THE PROPERTIES OF CARBON DIOXIDE HYDRATE A REVIEW OF PROPERTIES OF 51 GAS HYDRATES,

Syracuse Univ., N.Y. Dept. of Chemical Engineering and Materials Science.

J. G. Vlahakis, H. S. Chen, M. S. Suwandi, and A. J. Barduhn.

Available from the National Technical Information Service as PB-217 615, \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No 830, November 1972. 180 p, 48 fig, 44 tab, 187 ref. 14-30-2763.

Descriptors: *Desalination, *Crystallization, *Freezing, Ice, *Hydrate processes, Carbon dioxide.

Identifiers: *Hydrating agents, *Ice crystal growth.

This report consists of four parts. Part 1 gives a brief review of the status of choosing a hydrating agent for use in the hydrate process for desalting. Nine agents are listed and at least four appear to be good possibilities: R-12 (CCl₂F₂), R-142b (CH₃CCl₂F₂), R-152a (CH₃CHF₂), and R-31 (CH₂CIF). Of these R-31 looks best. Part 2 covers work on CO₂ hydrate for which the basic information are now available to make pilot plant designs and economic analyses. Part 3 is a review of the known properties of 51 gas hydrates including an extensive table of data and 80 references. Part 4 is concerned with ice crystal growth. The linear growth rate in the basal plane of unconfined ice crystals has been measured in flowing subcooled water and aqueous NaCl solutions. (OSW) W73-11156

INVESTIGATION OF POLYBENZIMIDAZOLE HOLLOW FIBER REVERSE OSMOSIS DESALINATION MEMBRANES,

Celanese Research Co., Summit, N.J.

A. A. Boom, H. J. Davis, M. Jaffe, L. A. Lee, and F. S. Model.

Available from the National Technical Information Service as PB-218 055, \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No 818, August 1972. 55 p, 6 tab, 24 fig, 7 ref. 14-30-2810.

Descriptors: *Reverse osmosis, *Membranes, *Desalination, Permeability, *Fouling, Compaction, *Morphology, Water transport.

Identifiers: Hollow fibers, Polybenzimidazole, Membrane fouling, Membrane compaction, Permeability instrument.

Laboratory evaluations have shown that PBI hollow fiber membranes possess outstanding desalination properties. Water flux as high as 10 gfd and salt rejections as high as 99% have been achieved. Structure-desalination performance correlations were established in morphological examinations employing thermomechanical analysis (TMA), optical microscopy and scanning electron microscopy. Radial void structure, void concentration and shrinkage behavior were found to be related at least in a semiquantitative way to desalination performance based on a Loeb-type membrane structure. Membrane fouling was established as the major cause of the observed decline in flux and rejection, with compaction playing a minor role. Fouling was virtually eliminated by installation of a highly efficient filtration system. Flow testing showed that PBI membranes produce an acidic shift of more than one pH unit in the product water relative to the feed (0.5% NaCl) stream, and to this is ascribed a unique water transport mechanism. The transport of water through PBI and cellulose acetate (CA) films was investigated with the aid of a new permeability instrument to obtain fundamental characterization data on materials possessing good reverse osmosis properties. (OSW) W73-11157

SPRAY FREEZING, DECANTING, MELTING AND HYDROLYSIS AS RELATED TO SECONDARY REFRIGERANT DESALTING,

Avco Corp., Wilmington, Mass. Avco Space Systems Div.

W. Gibson, G. Grossman, A. Modica, G. Siegelman, and G. Stepanoff.

Available from the National Technical Information Service as PB-218 056, \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No 816, July 1972. 17 p, 1 fig, 2 tab, 1 ref. 14-30-2770.

Descriptors: *Desalination, *Freezing, *Ice, *Hydrolysis.

Identifiers: Freon 114, *Spray freezer, Indirect melt, Hydrocyclone, Stripping, Decanting.

A secondary refrigerant freezing process is being developed which utilizes a pressurized wash column, indirect melter, and a nonflammable refrigerant. The performance of a spray freezer has been evaluated and it was found that a 50% yield could be achieved over a short fall height yielding crystal sizes in the range of 50-150 m. The crystals are platelets without evidence of dendritic growth. Freon utilization efficiency is close to 100% and production rates based on spray volume attain 600-700 lbs/hr ft³. The slurry has been compacted in a plug and pressure drop measurements have indicated permeabilities between 10-6 and 5 x 10⁻⁷ cm² at pressure drops up to psi/inch. Attendant upon secondary refrigerant freezing in any form is the removal of dispersed refrigerant from the ice-brine slurry which results from incomplete utilization in the freezer. A study of gravity decanting indicated that the characteristic times were too slow for a high rate compact desalting process, thus, the effort was switched to forced decanting as embodied in hydrocyclones. Two types of packing for vacuum strippers were evaluated for their feasibility in terms of cost and physical size. Hydrolysis of refrigerant represents an economic loss to a secondary refrigerant process. A study was conducted to define the magnitude of this problem particularly in terms of the refrigerant of choice F-114. A theoretical model was developed and checked experimentally. Remarkably good agreement was shown and hydrolysis losses were proved to be negligible. The process employs an indirect melting system to prevent contamination of the product water and loss of pump work associated with the pressurized wash column. Theoretical studies of melting phenomena leading to scaling laws were also conducted. (OSW) W73-11158

RESEARCH ON REVERSE OSMOSIS MEMBRANES FOR PURIFICATION OF WASH WATER AT STERILIZATION TEMPERATURE (165°F),

General Electric Co., Lynn, Mass.

J. M. Amore, J. F. Enos, and A. B. LaConti. Available from the National Technical Information Service as PB-218 162, \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No 815, December 1972. 57 p, 13 tab, 7 fig. 14-30-2752.

Descriptors: *Reverse osmosis, *Membranes, *Ion transport, Permeability, Separation techniques, Water purification.

Identifiers: *Wash water, Sulfonated polyphenylene oxide, Wash water renovation, Detergent removal (Reverse osmosis), Sterilization (Membranes), Urea removal.

The object of this research was to conduct the necessary modification and development of sulfonated 2,6-dimethyl polyphenylene oxide (PPO) membrane to obtain optimum reverse osmosis (RO) performance on synthetic and real wash water at sterilization temperatures (greater than or equal to 165°F) and maximum pressure of 800 psi. The goal was to obtain a RO permeate containing less than 10 microorganisms/cu and to achieve a stable flux of 5 gfd with rejections of NaCl (85.0%), urea (99.3%), lactic acid (99.0%) and detergent or soap (99.9%) with a synthetic wash water feed containing 1500, 1000, 700, and 10,000 ppm, respectively, of the wash water species. Solvent cast sulfonated PPO membranes were

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Saline Water Conversion—Group 3A

developed with IEC (Ion Exchange Capacity) ± 1.22 to 2.28 . It was demonstrated with real shower water that RO operation with these membranes at 165°F yields a permeate free of microorganisms. The low IEC membranes were shown to be extremely stable as evidenced by invariant fluxes and rejections during life tests of up to 3000 hours with 165°F wash water containing 10,000 to 20,400 ppm Olive Leaf (soap), Modified Approve (soap/detergent) and dodecylbenzene sulfonate (detergent). During a 3000-hour life test, a 1.36 IEC membrane exhibited a steady state of 3 to 5 gafd and average rejection of NaCl (97%), urea (45%), lactic acid (99%) and soap (99%). Decreasing the thickness of the 1.3 IEC membranes by approximately an order of magnitude (0.2 to 0.02 mil) increased the initial flux from 1.5 to 18.3 gafd with essentially no decrease in rejection. RO tests were successfully run at several temperatures (165 to 206°F), pressures (400 to 800 psi), and feed flow rates (0.04 to 2 gal/min) to help define the operating parameters for a practical hardware configuration. (OSW)

W73-11159

ION TRANSPORT THROUGH LAYERED ION EXCHANGE MEMBRANES.

Massachusetts Inst. of Tech., Cambridge, Mass.

A. A. Sonin, and G. Grossman.

Available from the National Technical Information Service as PB-218 236, \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No 814, July 1972. 48 p, 10 fig, 23 ref. 14-30-2749.

Descriptors: *Desalination, *Ion exchange, *Membranes, *Electrodialysis, *Ion transport.

Identifiers: Anion exchange membranes, Cation exchange membranes, Bipolar membranes, Laminar ion exchange membranes, Current-voltage characteristics.

The steady-state transport characteristics of a family of ion exchange membranes composed of contiguous layers of anion and cation exchange materials are described in terms of a simple physical model. Membranes consisting of up to four layers are considered. Explicit analytic expressions are derived which relate the current-voltage characteristics and transport numbers to the membrane structure and to the concentrations of the bounding solutions. The current-voltage characteristics are shown to be anisotropic with respect to current direction, showing current saturation in one or both directions, depending on membrane structure. The results are compared with available data on bipolar membranes. An analysis is also given for the general performance characteristics, including the effects of concentration polarization in the bounding solutions, of a three-layered membrane consisting of a thick central ion exchange layer sandwiched between two extremely thin ion exchange layers of opposite sign. This combination may serve as a model for the effects of certain types of membrane fouling in practical applications such as electrodialysis. It is shown that even very thin surface layers can reduce the limiting current to a value significantly below the diffusion-controlled one which is expected in the absence of the surface films. (OSW)

W73-11160

INVESTIGATION OF PHASE AND STATE RELATIONS IN COMPLEX LIPID SYSTEMS.

Philco-Ford Corp., Newport Beach, Calif.

Aeronutronic Div.

R. C. Bean.

Available from the National Technical Information Service as PB-218 237, \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Program Report No 812, November 1971. 60 p, 15 fig, 7 tab. 14-30-2710.

Descriptors: *Membranes, *Desalination, *Ion transport, *Lipids, Permeability, *Reverse osmosis.

Identifiers: *Lipid membranes, Water permeability, Thermal transitions, Amphiphilic lipids, Photoelectric reaction, Bilayer lipid membrane, Salt rejection, Lipid-loaded membranes, Lipid-Skin membranes, Cast lipid membranes.

Permeability was studied with lipids incorporated into membranes or dispersed in a bulk phase. Membrane forms included: the lipid-loaded membrane, in which membranes were prepared by saturating a microporous, polymeric support with lipids and then treating in various ways; the lipid-skin membrane, formed by compressing a thin film of lipid particles onto one face of a microporous support; the cast-lipid membrane, formed by casting a solution containing both lipid and polymer upon a glass surface; and the bilayer lipid membrane (BLM). Results of studies on the lipid-loaded membranes demonstrated that they generally had a low resistance at temperatures below a transition temperature near the melting point of the lipid. At this point, an abrupt 100 to 10,000-fold increase in resistance occurred in all cases, except with primary alkylamines. At temperatures below the liquifying transitions, some membranes had excellent ion selective properties with low resistance (10 to 50 ohm cm²). Various membranes, supported in cellulose ester microporous filters, produced photovoltaic and/or photoconductive responses to ultraviolet illumination. Photopotentials ranging up to 150 mv were obtained. Sensitization to visible light could be developed with certain dyes (e.g., methylene blue, rhodamine B). Polyamide membranes case with certain anionic or neutral long alkyl chain lipids incorporated into the casting solutions showed better water permeability and salt rejection than similar membranes prepared without lipids. (OSW)

W73-11161

A STUDY OF VAPOR PHASE POLYMERIZATION AND CROSSLINKING TO PREPARE REVERSE OSMOSIS MEMBRANES.

Research Triangle Inst., Durham, N.C.

H. Yasuda.

Available from the National Technical Information Service as PB-218 238, \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No 811, June 1972. 104 p, 38 fig, 23 tab, 43 ref. 14-30-2658.

Descriptors: *Desalination, *Reverse osmosis, *Membranes, *Sea water, *Permeability.

Identifiers: *Plasma polymerization, Silent-glow discharge, Composite membranes, Porous substrates, Ultra-thin-films, Organic-nitrogen-compounds, Dry-state-membranes.

Composite membranes are being prepared for use in sea water desalination via reverse osmosis by the vapor phase polymerization and crosslinking of heteroaromatic nitrogen compounds, aromatic amines and other nitrogen containing compounds in a silent glow discharge tube. The plasma formed ultrathin membranes have exhibited salt rejections greater than 99.5 percent at high water flux levels. Membrane performance was found to be stable after 20 days with no visible decline in water flux using 3.5% NaCl at 1500 p.s.i. It is anticipated that the plasma polymerization technique which is under development can be applied to porous substrates in planar, tubular and hollow fiber form. (OSW)

W73-11162

MEMBRANE FOULING IN ELECTRODIALYSIS: A MODEL AND EXPERIMENTS.

Massachusetts Inst. of Tech., Cambridge, Mass.

G. Grossman, and A. A. Sonin.

Available from the National Technical Information Service as PB-218 325, \$3.00 in paper copy.

\$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No 813, July 1972. 36 p, 7 fig, 15 ref. 14-30-2749.

Descriptors: *Desalination, *Membranes, *Electrodialysis, *Mathematical models, *Hydrodynamics, Ion exchange, Films.

Identifiers: Limiting current, *Membrane fouling, Colloidal deposits, Ion exchange films, Neutral fouling film, Charged fouling film, Polarization.

Membrane fouling is a common cause for poor performance in electrodialysis systems, usually because it reduces the limiting current. Fouling may be caused by deposits of either neutral matter or colloidal matter with ion exchange properties. In the present paper a model for membrane fouling is developed and expressions are derived for the reduction in limiting current caused by both neutral fouling films and films having ion exchange properties. The effect of fouling is shown to depend not only on the properties of the fouling film, but also on the hydrodynamic conditions in the channels and in the case of ion exchange fouling films on the salt concentration in the dialysate channel. Ion exchange fouling films are shown to be much more effective in reducing the limiting current than neutral films. Some experimental data are presented which confirm the trend of the theory for fouling with ion exchange films. (OSW)

W73-11163

THE ROLE OF DESALTING IN PROVIDING HIGH QUALITY WATER FOR INDUSTRIAL USE.

SCS Engineers, Long Beach, Calif.

C. J. Schmidt, and D. Ross.

Available from the National Technical Information Service as PB-218 463, \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No 819, December 1972. 146 p, 14-30-2776.

Descriptors: *Desalination, *Demineratization, Ion exchange, Membrane processes, Economic feasibility, Costs, *Industrial water.

Identifiers: *Industrial water users, Boiler feed water, Industrial plants, Nuclear plants, Electronics industry, Chemical process industries.

Literature searches, correspondence and field interviews were used to estimate demineralized water requirements of ten major industrial categories. Industrial boiler feed water treatment was the major volume use, followed by power generation, electronics manufacture and chemical process industries. Users of water containing less than 1 ppm TDS included nuclear-fueled power plants, and electronics manufacturers. Desalting equipment is applicable for partial demineralization followed by mixed-bed deionization. Industries requiring water with a quality of 2 to 10 ppm TDS included older fossil-fueled utility power plants, high pressure industrial boilers, chemical process, motor vehicle and aircraft, drug, and photographic supplies. Desalting equipment is applicable for partial demineralization followed by two-bed deionization. Industries requiring water with a quality of 10 to 200 ppm TDS included low pressure industrial boilers, food processors, and producers of primary metals, beverages, paper and bottled water. Partial demineralization by desalting may be the only treatment required. Curves were developed to illustrate cost vs. raw water quality for various product water qualities and treatment systems. Membrane desalting techniques become economically competitive with ion-exchange resins as the dissolved salts in the raw water increase. (OSW)

W73-11164

A NEUTRON SPECTROSCOPIC STUDY OF THE DIFFUSIVE KINETICS AND INTERACTIONS OF WATER IN DENSE LAYER DESALINATION MEMBRANES.

Union Carbide Corp., Tuxedo, N.Y.

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

G. J. Safford, and P. S. Leung.

Available from the National Technical Information Service as PB-218 547, \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No 834, July 1972. 53 p, 14 fig, 1 tab. 14-30-2891.

Descriptors: *Desalination, Physicochemical properties, *Reverse osmosis, *Membrane processes, Membranes, *Diffusion, *Kinetics.

Identifiers: *Neutron spectroscopy, Differential scanning calorimeter.

Neutron spectroscopic investigations were carried out to systematically study and determine, at a molecular level, the factors and properties that control the diffusion and bonding of water in 'dense skin' cellulose-acetate desalination membranes. Data were taken both to determine the functional form of the diffusive kinetics that characterizes the transport of H₂O molecules in membranes and then study the influence on the bonding and kinetics of the individual water of: (a) extent of membrane hydration, (b) number of hydrophilic groups, (c) variations in molecular weight, (d) temperature, (e) the presence of all included salt (NaCl), and (f) heat treatment and compaction and their relationship to the casting process. To complement the neutron scattering results, differential scanning calorimetric measurements were made to determine the transitions characteristic of the 'dense layer' materials. The relationship between these transitions and the membrane morphology as well as variations that result from different casting techniques and heat treatment are discussed. (OSW)

W73-1165

SALT AND NONELECTROLYTE INTERACTIONS IN WATER,

Pittsburgh Univ., Pa.

For primary bibliographic entry see Field 01B.

W73-1166

DISPERSION AND MISCELLY DISPLACEMENT,

Clarkson Coll. of Technology, Potsdam, N.Y.

Dept. of Chemical Engineering.

W. N. Gill, T. S. Lin, R. J. Nunge, M. Posner, and R. Sankarasubramanian.

Available from the National Technical Information Service as PB-218 549, \$3.00 in paper copy, \$0.95 in microfiche. Office of Saline Water Research and Development Progress Report No 822, December 1972. 132 p, 49 fig, 4 tab, 58 ref. 14-0001-1792.

Descriptors: *Dispersion, Convection, *Mixing, Mass transfer, *Desalination, Reviews.

Identifiers: *Miscible displacement.

The state of the literature when this work was begun can be summarized as follows: Dispersion models were assumed to apply to initial value problems like dispersion of a slug stimulus and transient boundary value problems like a uniform step change at the inlet to a tube, subject to the condition that they are valid only after a certain amount of time has elapsed since the start of the process. In such cases the dispersion coefficient was a constant depending upon flow geometry and conditions of flow if the flow was steady, and time dependent if the flow was time dependent. These models were, and still are, used to describe transport processes in a variety of situations such as chemical reactors, packed bed adsorption columns, double-pipe heat exchangers, etc. Using the series solution developed by Gill, the dispersion model can be derived from first principles, without making any arbitrary assumptions, in a more general form which describes unsteady convective diffusion phenomena right from time zero in initial value problems. Furthermore the method of analysis developed here takes into account non-uniformities in the initial distribution which occur in practical cases. The technique will be extended

to handle continuous source problems, such as material pollution into fluid streams, by using a superposition integral. Unsteady convective diffusion due to a step change at the inlet is a special case of the continuous source problem. Results were developed which show the approach with increasing time, of this solution to the Taylor-Aris description of the problem. Then, an approximate solution for dispersion in vertical flows with significant buoyancy forces is developed. (OSW)

W73-1167

W73-11237

REVERSE OSMOSIS WATER PURIFYING SYSTEM WITH GRADIENT BARRIER WATER STORAGE CONTAINER,

Desalination Systems, Inc., Escondido, Calif. (assignee)

D. T. Bray.

U.S. Patent No. 3,726,793, 2 p, 1 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 909, No 2, p 683, April 10, 1973.

Descriptors: *Patents, *Reverse osmosis, Separation techniques, *Desalination, *Water treatment, *Water purification, Water quality.

Identifiers: *Temperature gradient, Density gradient, Water storage container.

A reverse osmosis water purification system is provided with an easily cleaned storage container wherein a temperature gradient barrier is created at the interface between the purified product water and feed water to minimize intermingling of these waters. A product water storage container for the reverse osmosis water purification system supplies water product water to the upper end of the container and connects the lower end of the container to a line containing pressurized feed water. A pump produces pressure for the reverse osmosis process. The storage container is insulated to maintain the relative temperature of the two waters and to reduce the creation of convection currents. (Sinha-OEIS)

W73-11356

FLASH EVAPORATOR STRUCTURE,

Aqua-Chem, Inc., Milwaukee, Wis. (assignee)

R. W. Goeldner.

U.S. Patent No. 3,729,383, 4 p, 19 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 909, No 4, p 1348, April 24, 1973.

Descriptors: *Patents, *Flash distillation, *Evaporators, *Desalination, Equipment, Salt water, Water treatment, Water quality.

A horizontally arranged multistage flash evaporator is described. A tubular vessel is divided into many flash chambers by transverse partitions. At their lower end the partitions provide a passage for feedwater from chamber to chamber. The flow of feedwater is regulated to effect a water seal between chambers. (Sinha-OEIS)

W73-11358

A LITERATURE SURVEY—PERFORMANCE OF EXCEPTIONAL METALS IN CORROSIVE ENVIRONMENTS,

National Association of Corrosion Engineers, Houston, Tex.

For primary bibliographic entry see Field 08G.

W73-11479

NUCLEAR DUAL PURPOSE PLANTS IN REGIONAL DEVELOPMENT,

Atomic Energy Commission, Oak Ridge, Tenn.

D. F. Cope, J. C. Jorgenson, and M. Lopez.

Paper, Int Symp Plann Water Resour, Mexico City, Mexico, Dec 1972. 38 p, 2 fig, 28 ref.

Descriptors: *Distillation, *Water costs, Desalination, Nuclear powerplants, *Desalination plants, *Mexico, *Southwest US, Electric power production, Environmental effects, California, Water resources, Fresh water, Nuclear energy, Technology, Municipal water, Industrial water, Irrigation water, Ecology, Bibliographies.

Identifiers: Nuclear power, Dual purpose nuclear plants, Electric power production.

Advantages of coupling water distillation and electricity generating plants into dual purpose facilities for simultaneous production of fresh water and electricity has been recognized for some time.

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Conservation in Domestic and Municipal Use—Group 3D

Nuclear energy is well suited as an energy source for these large dual purpose facilities, and water distillation plants are adaptable for coupling to nuclear reactors. Cost of produced water is generally higher than the price of natural water. However, this cost will decrease as experience is gained from building and operating more and larger dual purpose plants. New incremental supplies of natural water are insufficient to meet projected needs of many regions of the world. Desalinating sea water using nuclear dual purpose plants seems to be the least expensive alternative for meeting future requirements. One region particularly suited for application of large nuclear powered dual purpose plants is Southwest US/Northwest Mexico. This region has rich productive land, but suffers from a shortage of fresh water, though the Pacific Ocean provides unlimited supplies of sea water for desalting. The role of dual purpose plants for this region and as related to other regions is discussed. (USBR) W73-11496

3B. Water Yield Improvement

EMERGING WATER SUPPLY TECHNOLOGY.
New York State Temporary Commission on the Water Supply Needs of Southeastern New York, Albany.
For primary bibliographic entry see Field 03D.
W73-11246

OPTIMUM HOLE DIAMETER FOR WATER WELLS,
For primary bibliographic entry see Field 08A.
W73-11468

THE IMPACT OF WEATHER MODIFICATION ON U.S. PLANNING FOR THE RIO COLORADO AND RIO GRANDE,
Bureau of Reclamation, Denver, Colo.
W. E. Howell
Paper, Int Symp Plann Water Resour, Mexico City, Mexico, Dec 1972, 11 p.

Descriptors: *Weather modification, *Meteorology, *Cloud seeding, Snowpacks, Planning, Clouds, Rainfall, Constraints, Costs, Snowfall, Precipitation (Atmospheric), Water management (Applied), Streamflow, Desalination, Flow augmentation, Water reuse, Rio Grande River, Colorado River Basin.
Identifiers: Western U.S. Water Plan, Skywater Project, Water resources management, Cloud modification, Induced precipitation.

Under Project Skywater, the Bureau of Reclamation is conducting research and experimentation to develop weather modification technology for application to water resources management problems. These activities include an experimental program of cloud seeding for increasing winter snowpack in the Jemez Mountains of New Mexico, which drains into the Rio Grande, and a pilot project for snowpack in the San Juan Mountains of Colorado, from which meltwater reaches both the Rio Grande and the Colorado Rivers. Results indicate that under certain meteorological conditions associated with temperature distribution within the cloud systems, cloud seeding increases precipitation by 100% or more. Potential streamflow increases depend upon the frequency of occurrence of favorable conditions in given geographic and climatic settings. Estimates of water augmentation by snowfall stimulation in the Colorado and Rio Grande Basins are being incorporated into the Western US Water Plan. Estimated snowfall stimulation will contribute approximately 2 million acre-ft annually, or about a 14% increase, to the flow of the Colorado River at Lee's Ferry, Arizona, and about 100,000 acre-ft annually to the flow of the Rio Grande River at Bernallillo, New Mexico. (USBR) W73-11505

WATERSHED RESEARCH,
Texas Tech Univ., Lubbock.
For primary bibliographic entry see Field 02A.
W73-11534

WATER RESOURCES INVENTORY OF CONNECTICUT: PART 6. UPPER HOUSATONIC RIVER BASIN,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 02A.
W73-11555

HIGH-TEMPERATURE CONTACT NUCLEATION OF SUPERCOOLED WATER BY ORGANIC CHEMICALS AND APPENDIX OF COMPOUNDS TESTED,
Naval Weapons Center, China Lake, Calif.
Michelson Labs.

A. N. Fletcher.
Available from NTIS, Springfield, Va 22151 as AD-753 465. Price \$3.00 printed copy; \$0.95 microfiche. Technical Publication 5439, November 1972, 16 p, 1 fig, 2 tab, 15 ref, append. (Reprinted from Journal of Applied Meteorology, Vol 11, No 6, p 988-993, September 1972.)

Descriptors: *Nucleation, *Freezing, *Organic compounds, Cloud seeding, Research and development, Testing procedures, Atmosphere, Temperature, Heat transfer, Supercooling, Weather modification, Artificial precipitation, Clouds, Evaluation.

In order to make an effective study and use of ice-nucleating agents for cloud seeding, it is essential that their characteristics be known under a range of conditions. A simple, rapid test is described that measures contact nucleation of supercooled water. Application of this contact-nucleation test at -3°C to over 1,000 organic compounds resulted in only 47 that could be considered as 'active'. Materials such as formaldehyde, fluorenone, phenazine and phloroglucinol dihydrate were not found to be sufficiently 'active' to pass the contact-nucleation test in an unground state. It is proposed that the initial water-air interface may pass through a configuration that promotes the growth of ice embryos even though the final compound-water interface has a low 'activity'; i.e., a low prewet-nucleation temperature. Conversely, some compounds such as phloroglucinol dihydrate show little 'activity' for contact nucleation yet have a high prewet-nucleation temperature. A table of compounds passing contact-nucleation test at -3°C includes their sources; average time to initiate freezing; percent of drops frozen unground and ground; and previously reported results. An appendix includes all organic compounds tested at -3°C for contact nucleation of supercooled water. (Woodard-USGS) W73-11699

3C. Use of Water of Impaired Quality

SHORT-TERM EFFECTS OF IRRIGATION WITH HIGH SODIUM WATERS,
New Mexico State Univ., University Park, Dept. of Agronomy.
J. U. Anderson, O. F. Bailey, and H. E. Dregne.
Soil Sci. Vol 113, No 5, p 358-362, 1972.
Identifiers: *Cotton-D, Irrigation, *Sodium waters.

The effects of 17 yr irrigations were studied to observe changes, to account for the initial success, and to relate changes in exchangeable sodium percentage (ESP) to predictive indices. Marked increases in ESP occurred in each of the 2 soil profiles in both surface and subsurface horizons. These increases were much greater in the soil which received an estimated 107 cm of irrigation annually than in the one which received an estimated 76 cm. Carbonate precipitation is believed

to be occurring in the latter, and measured ESP is greater than the sodium absorption ratio (SAR). ESP is lower than SAR in the soil receiving the larger amount of irrigation water, indicating that equilibrium has not yet been achieved. The correlation coefficient (*R*) for ESP vs. estimated ESP was 0.91. The critical level of ESP for cotton growth appears to be about 25 in this situation.—Copyright 1972, Biological Abstracts, Inc.
W73-11111

COLORADO RIVER WATER QUALITY IMPROVEMENT PROGRAM.
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 05G.
W73-1124

3D. Conservation in Domestic and Municipal Use

NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY : APPENDIX H, MINERALS.
Bureau of Mines, Washington, D.C.

North Atlantic Regional Water Resources Study Coordinating Committee Report, May 1972, 98 p, 14 fig, 4 tab.

Descriptors: *Water quality, *Mineralogy, *Mineral industry, *New England, *Water pollution sources, Water pollution control, Pollution abatement, Metals, Mining, Industrial production, Reviews, Projections, River basins.

Identifiers: *Mineral resources, North Atlantic Region, Middle Atlantic areas, Non-metals.

This report was compiled at the request of the Army Corps of Engineers and is a general appraisal of the mineral resources of the North Atlantic Region (NAR). Data were compiled on the water-related mineral commodities and their resources. Emphasis was placed on those minerals whose production or processing involves the use of significant quantities of water, or may cause water pollution, or may result in solid waste disposal problems. The study covers the mineral industry in all New England States, New Jersey, Delaware, and those portions of New York, Pennsylvania, Maryland, Virginia, and West Virginia that are in the New England and Middle Atlantic areas established by the Water Resources Council and designated as the North Atlantic Region. The analysis of data on water use by the mining industry and its waste water disposal problem is included. Data were compiled on the quantity and value of minerals produced in the Region in 1964. A table shows values of mineral production for all counties in NAR in 1969 and 1970. Water use data for 1962, obtained by canvassing mineral producers, were used to estimate future water requirements based on projections of mineral production. (Woodard-USGS) W73-11107

ENVIRONMENTAL HEALTH PLANNING.
Bureau of Community Environmental Management, Rockville, Md.
For primary bibliographic entry see Field 05G.
W73-11244

SCOPE OF PUBLIC WATER SUPPLY NEEDS.
New York State Temporary Commission on the Water Supply Needs of Southeastern New York, Albany.
For primary bibliographic entry see Field 06D.
W73-11245

EMERGING WATER SUPPLY TECHNOLOGY.
New York State Temporary Commission on the Water Supply Needs of Southeastern New York,

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3D—Conservation in Domestic and Municipal Use

Albany.

March 1, 1973. 106 p, 11 fig, 9 tab, 24 ref, 2 append.

Descriptors: *Water supply, *Desalination, *Weather modification, *Water reuse, *Groundwater recharge, Water demand, Environmental effects, *New York.

Identifiers: Southeastern New York, *New York City.

Three technological means for increasing the water supply in southeastern New York, including New York City, are evaluated by a state commission appointed by Governor Rockefeller. The commission was to determine longrange water supply needs, evaluate alternatives to meet the needs, and make recommendations based on costs, administration feasibility, and environmental impacts. The emphasis of this report is on the technological alternatives of desalination, weather modification, and waste water reuse. Desalination was not recommended for southeastern New York because of excessive costs and problems of plant location and brine disposal. Weather modification was not recommended because of the uncertainty involved, the likelihood of only small increases in water supply, and the need to construct more reservoirs to hold water. Direct reuse and recycling of waste water was not recommended because of dangers to public health, however, indirect reuse was recommended, particularly groundwater recharge. For example, there is great potential for deep well recharge on Long Island. (Elfers - North Carolina) W73-11246

WATER SUPPLY PLAN FOR THE SOUTHEASTERN CONNECTICUT REGION, VOLUME II, RECOMMENDED PLAN.

Southeastern Connecticut Water Authority, Norwich; and the Southeastern Connecticut Regional Planning Agency, Norwich.

For primary bibliographic entry see Field 06B.
W73-11249

BROWN COUNTY SEWAGE AND SOLID WASTE STUDY - 1972.

Brown County Regional Planning Commission, Green Bay, Wis.

For primary bibliographic entry see Field 05E.
W73-11250

HOUSING AND PLANNING REFERENCES.

Department of Housing and Urban Development, Washington, D.C.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price \$1.75, New Series No 46. January-February, 1973. 96 p.

Descriptors: *Bibliographies, *Publications, *City planning, Water supply, Sewerage, Recreation, Pollution abatement, Natural resources, Environment effects, Ecology.

This selective bibliography contains 1470 references to publications and articles received by the Library of the Department of Housing and Urban Development. Subject entries in the main text (808 ref.) are primarily oriented toward housing, urban design and land use planning. However, several categories relate to urban water resources including ecology and environment, natural resources, pollution control, recreation, sewage disposal and storm sewers, and water supply. Comprehensive Planning (701) reports (662 ref.) are listed geographically by states and give HUD Library accession numbers. A list of 14 new periodicals and a selection of books are included. (Hufschmidt-North Carolina)
W73-11251

REGIONAL WASTE WATER, SOLID WASTE DISPOSAL, WATER SUPPLY, AND STORM DRAINAGE SYSTEMS APPRAISAL.

Harza Engineering Co., Chicago, Ill.

For primary bibliographic entry see Field 05G.
W73-11252

URBANIZATION'S DRAINAGE CONSEQUENCE,

Nolte (George S.) and Associates, San Jose, Calif.; and San Diego County Comprehensive Planning Organization, Calif.

For primary bibliographic entry see Field 04C.
W73-11254

COMMUNITY IMPROVEMENTS AND SERVICE COSTS,

South Dakota State Univ., Brookings.

M. L. Anderson.
Journal of the Urban Planning and Development Division, American Society of Civil Engineers, Vol 99, No UPI, p 77-92, March, 1973. 15 fig, 2 tab, 4 ref.

Descriptors: *Public utilities, *Cost analysis, Sewerage, Water supply, Construction costs, Design criteria, Planning, *Wisconsin.

Identifiers: *Milwaukee Metropolitan Region.

The relationships between urban population density and costs of public utilities, i.e. sanitary sewer and water mains, are explored in this study. Data are taken from four suburbs around Milwaukee and synthesized to produce various cost curves. There is a need for cost data on public utility extensions and maintenance in order to develop planning and design standards. It was expected that an optimal population density for minimizing costs would be found, but such a level is not clear from the analysis. Some of the conclusions are that (1) the cost of construction of sanitary sewer mains increases at a decreasing rate up to about 12 persons per acre and decreases from 12 to 16 persons per acre; (2) the cost of sanitary sewer maintenance increases at a decreasing rate; and (3) the construction cost of water distribution systems increases up to 12 persons per acre and then decreases from 12 to 16 persons per acre. The article includes 15 graphs representing these data. (Elfers-North Carolina)
W73-11255

PUBLIC PARTICIPATION IN URBAN WATER PLANNING,

Fort Lewis Coll., Durango, Colo.

For primary bibliographic entry see Field 06B.
W73-11257

MOBILE AREA WATER TRANSPORTATION STUDY OF MOBILE, BALDWIN AND ESCAMBIA COUNTIES, ALABAMA.

Tippetts Abbott McCarthy Stratton, New York.

For primary bibliographic entry see Field 08A.
W73-11260

COMPREHENSIVE WATER SEWER PLAN FOR BALDWIN COUNTY, ALABAMA.

Polyengineering, Mobile, Ala.

For primary bibliographic entry see Field 05D.
W73-11261

COMPREHENSIVE WATER AND SEWER PLAN FOR ESCAMBIA COUNTY, ALABAMA.

Polyengineering, Mobile, Ala.

For primary bibliographic entry see Field 05D.
W73-11262

PUBLIC UTILITIES IN WINNEBAGO COUNTY.

City-County Planning Commission, Rockford, Ill.

Series No RWCCPC-70-3, August 1970. 141 p, 14 fig, map, 24 ref, 2 append. Ill. P-217.

Descriptors: *Planning, *Water distribution, *Sewerage, Project planning, Utilities, Financing, Water management, Water demand, *Illinois.

Identifiers: *Utility extension planning, Rockford (Ill), Winnebago County (Ill).

The inventory and analysis of existing water supply and sanitary sewer systems plus recommendations for future expansion are presented. The analysis consists of some basic discussions of water supply systems, water demands, sanitary sewer and treatment systems, and septic tank problems. The extension plans are presented in detail via maps and project listings and are based on metropolitan goals and policies and related to land use planning. The study is particularly concerned with the implementation of the proposed extensions and recommends careful financial planning including the use of service charges, the creation of a water supply authority well in advance of the future need to develop surface water supplies, and the extension of the present sanitary district to cover most of the county. Storm water drainage is recommended to be studied in a separate report. (Elfers-North Carolina)
W73-11263

3E. Conservation in Industry

THE ROLE OF DESALTING IN PROVIDING HIGH QUALITY WATER FOR INDUSTRIAL USE,

SCS Engineers, Long Beach, Calif.

For primary bibliographic entry see Field 03A.
W73-11164

MINERAL INDUSTRY VS. ECOLOGY.

For primary bibliographic entry see Field 05G.
W73-11185

ENERGY VS. ENVIRONMENT,

For primary bibliographic entry see Field 06G.
W73-11500

3F. Conservation in Agriculture

RESPONSE OF RELATIVE WATER CONTENT IN ZEA MAYS L. TO CHANGES OF POTENTIAL IN THE RHIZOSPHERE AND ATMOSPHERE,

Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.

L. A. Downey.
Agric Meteorol. Vol 10, No 1/2, p 137-140, 1972. Illus.

Identifiers: *Atmosphere, Floods, Irrigation, *Soil matric potential, Relative water content, *Rhizosphere, Soils, Vapor pressure deficit, *Zea-Mays-M.

Relative water content (RWC) of Z. mays was depressed by both an increase in vapor pressure deficit (VPD) or by a decrease in soil matric potential. When the soil matric potential \pm 1.5 bar an increase of 80 mbar in VPD depressed the RWC by 30%; indicating that, with flood irrigation, it may be difficult to completely eliminate water stress in crops grown in semi-arid regions.—Copyright 1972, Biological Abstracts, Inc.
W73-11145

PROGRAMMING MODEL FOR EVALUATING ECONOMIC AND FINANCIAL FEASIBILITY OF IRRIGATION PROJECTS WITH EXTENDED DEVELOPMENT PERIODS,

California Univ., Davis, Dept. of Agricultural Economics.

G. W. Dean, H. O. Carter, Y. Isyar, and C. V. Moore.

Water Resources Research, Vol 9, No 3, p 546-555, June 1973. 4 fig, 1 tab, 6 equ, 14 ref.

Descriptors: *Linear programming, *Irrigation, Projects, *Economic efficiency, *Financial feasibility, *California, Water resources, *Planning, Agriculture, Crops, Costs, Equations, Mathematical models, Systems analysis, Cost-benefit analysis.

Identifiers: *San Joaquin Valley (Cal.), Repayment analysis.

A multiperiod linear programming model of regional irrigation development is formulated to provide an operational approach to improved evaluation of economic efficiency (benefit-cost analysis) and financial feasibility (repayment analysis) of irrigation projects. The model is particularly useful where the time path of development is critical, for example, in large projects where market restrictions for the products produced may permit only a gradual approach to full development over a long period of time; the MPLP model incorporates sufficient flexibility to handle a wide range of differing empirical situations. The relationship of the model to economic theory and current agency practice is briefly outlined. An empirical application of the model to a large-scale component of the California water plan is reported; results show some deficiencies in previous planning procedures that may lead to difficulties in project repayment and create unforeseen negative welfare effects on nonproject producers. (Bell-Cornell)
W73-11149

STOCHASTIC RESERVOIR MANAGEMENT AND SYSTEM DESIGN FOR IRRIGATION,
New South Wales Univ., Kensington (Australia).
School of Economics.
N. J. Dudley, and O. R. Burt.
Water Resources Research, Vol 9, No 3, p 507-522, June, 1973. 3 fig, 22 ref.

Descriptors: *Stochastic processes, *Reservoirs, *Management, *Design, *Irrigation, *Dynamic programming, Crops, Optimization, Simulation analysis, Irrigation efficiency, Estimating, Water resources development, Acreage, Value, Benefits, Decision making, Systems analysis, Mathematical models, Variability.
Identifiers: Design variables, Interseasonal, Intraseasonal, Intertemporal, Water application rates, Reservoir capacity, Distribution systems.

An integrated intraseasonal and interseasonal stochastic dynamic programming model is developed to determine an optimal decision rule with respect to the following classes of crop irrigation decisions: (1) intertemporal water application rates; (2) whether or not some acreage should be relinquished from further irrigations for the remainder of the season; and (3) the optimal acreage to plant for potential irrigation at the beginning of the season. Solutions of the problem are shown to be a basis for optimizing the levels of three design variables: Developed irrigation acreage, reservoir capacity, and distribution system capacity. A method is presented for incorporating variance, as well as expected value, of the net benefits into the decision criterion for optimal developed acreage. An application is made to a simplified real situation in which optimal acreage to develop is the only design variable. State variable transition probabilities are calculated by a simulation model. A significant trade-off is found between expected net benefits and their variability in determination of the optimal developed acreage for irrigation. (Bell-Cornell)
W73-11152

RADIAL PROPAGATION OF WATER POTENTIAL IN STEMS,
Auburn Univ., Ala. Dept. of Civil Engineering.
F. J. Molz, and B. Klepper.
Agron J. Vol 64, No 4, p 469-473, 1972. Illus.
Identifiers: Bark, *Cotton-D, Diffusion, Equations, Gossypium-Hirsutum-D, Mathematical studies, Phloem, *Radial propagation (Plants), Stems, Xylem.

Contraction and expansion of a cotton (*Gossypium hirsutum* L.) stem in response to a diurnal cycle of leaf water potential is described mathematically using a passive diffusion analysis. The domain of the problem is the stem phloem and associated tissues that are bounded on the outside by impervious bark and on the inside by the xylem that is assigned measured values of leaf water potential. Semiquantitative predictions are derived from numerical solutions of the linear radial diffusion equation, which yield phloem water potential as a function of space and time. Computations relating stem diameter, leaf water potential, and water flow between xylem and phloem fit experimental data. An apparent hysteresis in the stem diameter-leaf water potential relationship is partly explained in terms of the physics of the diffusion process in the stem. This study offers possibilities for relating internal plant water status to measurable external quantities such as stem diameter and for developing a nondestructive technique for the determination of plant xylem water potential.—Copyright 1972, Biological Abstracts, Inc.
W73-11181

COMPARISON OF SIMULATED AND ACTUAL EVAPORATION FROM MAIZE AND SOIL IN A LYSIMETER,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 02D.
W73-11201

FREEZE-FREE (32 F) SEASONS OF THE MAJOR BASINS AND PLATEAUS OF NEVADA,
National Weather Service, Reno, Nev. Weather Service Office.
For primary bibliographic entry see Field 07C.
W73-11218

INFLUENCE OF SOIL TEMPERATURE AND MOISTURE ON SURVIVAL AND GROWTH OF STRANDS OF PHYMATOTRICHUM OMNIVORUM,
Ruhr-Universitaet Bochum (West Germany). Lehrstuhl fuer Pflanzphysiologie.
J. E. Wheeler, and R. B. Hine.
Phytopathology. Vol 62, No 8, p 828-832, 1972. Illus.

Identifiers: *Cotton, Fungus, Germination, Growth, *Phytophthora-omnivorum, Soils, Survival, Soil temperature, Soil moisture.

Strands of *P. omnivorum* on roots of cotton plants killed by the fungus during the summers of 1968 and 1969 were not viable after midsummer of 1969 and 1970, respectively. Strands buried 25 cm deep in the rhizosphere of cotton plants growing in the field did not survive longer than 3 mo. Strands introduced into nonsterile Gilia silt loam (GSL) at 10 deg C at initial moisture levels of 12, 22 and 30% (equivalent to 15, 1/3 and 1/10 atmospheres tension, respectively) were viable after 9 mo. when moisture levels had decreased to as low as 8% (oven-dry basis). No strands survived 6 mo. at 27 and 32 deg C at the 3 moisture levels. Optimum strand formation occurred at 27 and 32 deg C in nonsterile GSL at 22 and 30% moisture levels. Strand formation was sparse at 16 and 35 deg C. No structures occurred at 10 or 40 deg C. Strands placed in nonsterile GSL at 22% moisture, germinated at 10 deg -32 deg C, but not at 35 deg C.—Copyright 1972, Biological Abstracts, Inc.
W73-11248

FERTILIZER RESPONSE TO THE PHYSICAL EFFECTS OF SOIL COMPACTION,
Uttar Pradesh Inst. of Agricultural Sciences, Kanpur (India).
Y. P. Singh, and R. N. Gupta.
J Indian Soc Soil Sci. Vol 19, No 4, p 345-352, 1972. Illus.
Identifiers: *Fertilizers, Growth, Nutrients, *Soil compaction, *Wheat-M, Yield, Soil physical properties.

The effect of fertilizer response to various levels of soil compaction on the growth, nutrient uptake and yield of wheat in an artificially compacted fine sandy loam soil was studied. Eight levels of compaction (1.11, 1.18, 1.26, 1.35, 1.44, 1.53, 1.61 and 1.70 gm/cc) and 2 levels of fertility (control and 150 ppm N + 75 ppm P2O5 + 75 ppm K2O) were tried in 3 replications. Compacting the soil from 1.11-1.70 gm/cc resulted in large decrease in its total and aeration porosity and hydraulic conductivity. The relationship between bulk density of soil and crop growth or nutrient uptake was parabolic in nature. An optimum compaction of 1.35 gm/cc was most favorable for crop growth. Fertilization failed to alleviate the adverse effect of soil compaction. Fertilizer response was maximum at the optimum bulk density of 1.35 gm/cc and was considerably reduced at higher and lower compaction levels. Interaction between compaction and fertility was significant for number of ear bearing tillers, uptake of N and P.—Copyright 1972, Biological Abstracts, Inc.
W73-11230

THE EFFECTS OF WATER STRESS ON NITROGEN-FIXING ROOT NODULES: II. EFFECTS OF THE FINE STRUCTURE OF DETACHED SOYBEAN NODULES,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
J. I. Sprent.

New Phytol. Vol 71, No 3, p 443-450, 1972. Illus.
Identifiers: Air, Cells, Cortex, Cytoplasm, Infected, Mitochondria, *Nitrogen-fixing nodules, Nodules, Pericycle, Plasmodesmata, Ribosomes, *Root nodules, *Soybean-D nodules, Tissue, Vacuole, Vascular traces.

The fine structure of the noninfected (outer) region of a soybean root nodule is described. Apart from vascular traces, the cells are mainly vacuolate, with active cytoplasm. They are connected with each other and to cells of the infected region by numerous plasmodesmata. A network of air spaces runs throughout the nodule. Atmospherically applied water stress affects the outer cells of the nodule more quickly and more severely than the inner cells. In any region, vacuolate cells are more susceptible to stress than nonvacuolate cells. Loss of about 30% of their fresh weight results in breakdown of the cytoplasm into approximately spherical subunits, some of which are coated with organelles. Organelles such as nuclei and mitochondria retain their structure longer than the rest of the cytoplasm. More severe stress is needed to affect infected and pericycle cells, which are nonvacuolate. It is concluded from the fine structure of stressed and unstressed nodules that the vacuolate cells of the cortex play an integral part in the N-fixing activities of the whole nodule. (See also W72-02633 and W73-11416)—Copyright 1972, Biological Abstracts, Inc.
W73-11415

THE EFFECTS OF WATER STRESS ON NITROGEN-FIXING ROOT NODULES: III. EFFECTS OF OSMOTICALLY APPLIED STRESS,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
J. I. Sprent.

New Phytol. Vol 71, No 3, p 451-460, 1972. Illus.
Identifiers: Acetylene, Applied, Cells, Cortical, Mannitol, *Nitrogen-fixing nodules, *Osmotic stress (Plants), Respiration, Root nodules, Roots, Salt, Solutions, *Soybean-D roots.

The effects of osmotic stress on N fixation and respiration of soybean root nodules were investigated. Nonelectrolytes, such as mannitol, depressed acetylene reduction when given to detached nodules in sufficient concentration to withdraw water from them. When given to the root systems of whole plants, hypotonic concentrations of mannitol had a depressing effect after 1-2 hr, the exact time depending on the size of the nodules. Equivalent concentrations of salts had a

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation in Agriculture

much more rapid effect on whole root systems and on detached nodules (less than 5 min); 100 meq/l almost stopped acetylene reduction by small nodules. These effects could not be transmitted via the roots and needed contact between salt solution and nodules. They were accompanied by a decrease in respiratory activity and were fully reversible if the root systems were flushed with water within a few hours of treatment. High salt concentrations, as in sea water, had a rapid (1-2 min) effect, which after 20 min became irreversible. The effects of salt stress are interpreted as resulting from alterations in the metabolism of the cortical cells of the nodules. (See also W73-11415).—Copyright 1972, Biological Abstracts, Inc.

W73-11416

HYDROLOGY OF TRUCKEE MEADOWS, NEVADA,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 04B.
W73-11430

PREDICTION MODELING FOR SALINITY CONTROL IN IRRIGATION RETURN FLOWS,
Robert S. Kerr Environmental Research Lab., Ada, Okla.
For primary bibliographic entry see Field 05G.
W73-11441

WATER REQUIREMENTS FOR OPTIMUM CROP YIELD,
Corps of Engineers, West Palm Beach, Fla.
S. F. Shih, R. E. Sneed, and R. S. Sowell.
Paper 72-773, 1972 Annual Meeting American Society of Agricultural Engineers, Chicago, Ill., Dec 1972. 16 p, 6 tab, 5 ref.

Descriptors: *Agronomy, *Water requirements, *Crops, Mathematical models, Water utilization, Root systems, Time, Irrigation efficiency, Computer programs, Consumptive use, Crop response, Soil-water-plant relationships, Fourier analysis, Growth stages, Growth rates, Root development, Soils, Plant growth, Crop production.
Identifiers: Coefficients.

Two mathematical models developed to provide input for determining agricultural water requirements are presented. One determines the water requirement of a plant as a function of time after planting; the other determines the rooting depth as a function of time from date of planting and soil type. Both models are formulated to make daily calculations from planting date through maturity. Computer programs were developed to determine coefficients of the equations presented. With these coefficients, the model was then used to predict water use and rooting depth of plants as a function of time during the growing season. Predicted water use agreed closely with observed data for selected crops grown in North Carolina. Applications of the water use model and the root depth model are tabulated. With the tabulated data and rainfall data, the water-holding capacity of the soil will be used to determine irrigation water requirements for each soil/crop combination in any of the 60 time intervals during the year. (USBR)
W73-11507

REHABILITATION OF IRRIGATION SYSTEMS FOR SALINITY CONTROL,
Colorado State Univ., Fort Collins.
G. V. Skoogboe, and W. R. Walker.
Paper 72-761, 1972 Annual Meeting American Society of Agricultural Engineers, Chicago, Ill., Dec 1972. 13 p, 11 ref, append.

Descriptors: *Return flow, *Salinity, *Water quality control, *Hydraulic structures, Irrigation water, Rates of application, Canal seepage, Water quality, Subsurface drainage, Water management (Applied), Irrigation operation and maintenance,

Irrigation practices, Consumptive use, Irrigation design, Agricultural engineering, Automatic control.

Prevention or control of salinity added to water sources from irrigation return flow is both difficult and expensive. Potential solutions and control measures involve rehabilitation of the irrigation system by structural improvements and improving water distribution to better control cropland applications. Purposes and design criteria for some fundamental hydraulic structures discussed are: canal turnouts, control structures, flow measuring structures, canal linings, and farm structures. Automation and prefabrication are seen as time, labor, and money-saving aspects of successful system rehabilitation. Distribution system management methods must be revised so that only the required water is delivered to individual turnouts. Mandatory use of call periods will aid on farm irrigation efficiencies by encouraging farmers to plan their irrigation. Irrigation scheduling services combining meteorological data and soil moisture levels to forecast future irrigations in applied depths as well as timing are described. The importance of canal maintenance, managing system storage reservoirs, and managing waste water are discussed. Increasing water-use efficiency is not only a requirement for greater production, but is also necessary to reduce the impacts of water quality degradation. (USBR)
W73-11509

CROP RESPONSE TO TRICKLE AND SUBSURFACE IRRIGATION,
Texas A and M Univ., College Station.
E. A. Hiler, and T. A. Howell.
Paper 72-744, 1972 Annual Meeting American Society of Agricultural Engineers, Chicago, Ill., Dec 1972. 22 p, 6 fig, 3 tab, 18 ref.

Descriptors: *Crop response, *Irrigation efficiency, *Subsurface irrigation, *Trickle irrigation, Consumptive use, Evapotranspiration, Growth rates, Lysimeters, Irrigation practices, Irrigation systems, Irrigation water, Mist irrigation, Wind speed, Moisture content, Sorghum, Surface irrigation, Bibliographies, Crop production.

An investigation was conducted to compare water-use efficiencies using different irrigation methods, and to evaluate effects of reduced irrigation amounts on yields using trickle irrigation. Grain sorghum was grown during 1971-72 in a field lysimeter installation where complete control of the soil water could be maintained. Irrigation treatments included subsurface, trickle, subsurface plus mist, trickle plus mist, and surface. Water measurements were made to determine irrigation amount, storage depletion, and drainage amount, so that total crop water use could be determined. Trickle and mist treatment resulted in the highest water efficiencies. The increase in water-use efficiency based on total water use was 42% for trickle treatment compared to surface treatment. Grain sorghum growth as indicated by crop height and leaf area index was greater for all 1971 intensive treatments than for the surface treatment. Comparison of 3 levels of trickle irrigation amounts in 1972 indicates that water-use efficiency increased by 50% with sparing trickle applications. (USBR)
W73-11513

WATER INFILTRATION UNDER CENTER-PIVOT SPRINKLERS,
Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 06B.
W73-11514

THE ORIGIN AND DOMESTICATION OF SORGHUM BICOLOR,
Illinois Univ., Urbana. Dept. of Agronomy.
J. M. J. DeWet, and J. R. Harlan.
Econ Bot. Vol 25, No 2, p 128-135. 1971. Illus.

Identifiers: Distribution patterns, Domestication, *Morphological variability, *Sorghum-Bicolor-M.

The distribution, morphological variability, affinities and ethnobotany of Sorghum varieties are discussed. The wild representatives of *S. bicolor* are strictly African in distribution. Descriptions are given of the different races. *S. bicolor* is an exceptionally complex sp. Cultivated sorghum is grown in regions with 10-120 in. annual rainfall. Sorghum was probably introduced into China some time after the beginning of the Christian era. Sorghum is absent from excavated early farming sites in the Near East. It may have been introduced into India from Africa by the end of the 2nd millennium B.C. Sorghum domestication may have been accomplished soon after agriculture was introduced into Bantu Africa.—Copyright 1972, Biological Abstracts, Inc.

W73-11561

FINANCING PRIVATE WATER RESOURCE DEVELOPMENT: ANALYSIS OF A STATE LOAN PROGRAM,
Wyoming Univ., Laramie. Div. of Agricultural Economics.
T. L. Dobbs, C. E. Olson, W. G. Wedemeyer, and G. H. Pfeiffer.
Water Resources Bulletin, Vol 9, No 1, p 129-139, February, 1973. 4 fig, 2 tab, 10 ref.

Descriptors: Water resources development, *Financing, *Investment, Economic feasibility, *Sprinkler irrigation, *Wyoming, *Irrigation programs, Agriculture, Farms, Regional development.

Identifiers: Economic analysis, *State loan programs, Farm growth, Forage crops, Groundwater development, Feasibility analysis.

Resulting from a marked decline in Federally financed water resources development, Western States are looking increasingly inward for support of irrigation projects. A State loan program is analyzed for its effects on groundwater development in Wyoming. The analysis focuses on the effects of low-interest State financing on the economic feasibility of investments in center-pivot sprinkler irrigation systems. The feasibility analysis indicates that investments in sprinkler systems for production of cash crops are highly profitable, and would frequently be carried out whether or not the State loan program were available. Investments in sprinklers for production of forage crops are perhaps frequently made attractive by the loan program. Thus, while the program appears to have accelerated the pace of private water resource development in Wyoming, it has also subsidized some investments that would have been carried out regardless of the program's existence. Further analysis indicates that sprinkler investments carried out with State financing contribute substantially to firm growth when cash crops are grown, but have less marked, and sometimes negative, effects on growth when forage crops are produced. Some positive effects of the loan program on southeast Wyoming's regional economy are noted, but a complete empirical analysis of regional impacts is beyond this study's scope. (Bell-Cornell)
W73-11686

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

EFFECTS OF SUBMERGED SILLS IN THE ST. CLAIR RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 06B.
W73-11089

WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Control of Water on the Surface—Group 4A

VIRGINIA SMALL STREAMS PROGRAM, PRELIMINARY FLOOD-FREQUENCY RELATIONS,
Geological Survey, Richmond, Va.
For primary bibliographic entry see Field 02E.
W73-11090

KARST LANDSCAPES AND KARST FORMS (KARSTOVYYE LANDSHAFTY I TIPY KARSTA),
Moscow State Univ. (USSR). Kafedra Fizicheskoi Geografii.
N. A. Gvozdetskiy.
Vestnik Moskovskogo Universiteta, Seriya V, Geografiya, No. 5, p 16-22, September-October 1972. 26 ref.

Descriptors: *Karst, *Karst hydrology, Geomorphology, Drainage effects, Soils, Vegetation, Subtropic, Tropic.
Identifiers: USSR, *Karst topography, *Cuba.

A karstland is a unique physiographic complex and geographical landscape. The extent to which karst rocks and karst processes influence the landscape is determined by whether karst rocks outcrop directly at the surface of the ground, are covered with soil, or are overlain by nonkarstic material. Landscape features are most affected by denuded karst and least affected by buried or fossil karst. Karst studies made in Cuba in 1971 have shown that, in addition to mogotes (residual hills in the tropics), there are morphological and genetic forms of karst which must be considered as special tropical forms, despite their similarity to karst of temperate zones. (Josefson-USGS)
W73-11102

PROTECTION AND CONTROL OF THE SALT WATER SHORE AREA.
Rhode Island Statewide Planning Program, Providence.
For primary bibliographic entry see Field 06E.
W73-11114

UNSUPERVISED SPATIAL CLUSTERING WITH SPECTRAL DISCRIMINATION,
National Aeronautics and Space Administration, Huntsville, Ala. George C. Marshall Space Flight Center.
For primary bibliographic entry see Field 07C.
W73-11116

ITERATIVE SIMULATION ALGORITHM IN RESERVOIR SYSTEMS OPERATION,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
T. P. Chang, and G. H. Toebes.

Paper presented at International Association of Hydraulic Research. 1973. 8 p, 2 fig, 6 ref. OWRR-A-026-IND (1).

Descriptors: *Reservoir operation, *Reservoir storage, *Simulation analysis, *Multiple purpose reservoirs, *Flood control, *Water supply, Model studies.

For the operation of a multi-unit reservoir system with many control centers (check points, or feed-back points, etc.) the building of a true systems policy leads to solving a very large set of many simultaneous, constrained equations. This problem is a key difficulty in building a systems operating policy. This paper relates how it can be solved in a trial and error fashion by an especially developed algorithm, which is called the 'iterative simulation algorithm'. It is applicable to systems policies for large numbers of reservoirs both in series as well as in parallel.
W73-11139

STOCHASTIC RESERVOIR MANAGEMENT AND SYSTEM DESIGN FOR IRRIGATION,
New South Wales Univ., Kensington (Australia). School of Economics.
For primary bibliographic entry see Field 03F.
W73-11152

SOIL PHYSICAL FACTORS AFFECTING ROOT MORPHOLOGY AND STABILITY OF SCOTS PINE ON UPLAND HEATHS,
M. E. Faulkner, and D. C. Malcolm.
Forestry. Vol 45, No 1, p 23-36, 1972. Illus.
Identifiers: England, Morphology, Physical properties, *Pine-G, *Pinus-Sylvestris-G*, *Roots, Stability, Upland heaths.

Forty trees, on 5 heathland soil types, were pulled over and their resistance compared with described profile and physical features. Root morphology was found to be important for stability as was stem weight and soil strength. Ironpans reduce permeability to vertical drainage and delay but do not bar limited root penetration to the lower horizons. Root extension ceases at soil densities of about 1.5 g/cc. On freely rooted profiles root systems may continue to expand but on ironpan soils have occupied available space (at 30 yr) and further increases in tree size will result in increased instability.—Copyright 1972, Biological Abstracts, Inc.
W73-11173

STEADY-STATE SEEPAGE IN A HILLSIDE,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 02G.
W73-11212

FREEZE-FREE (32 F) SEASONS OF THE MAJOR BASINS AND PLATEAUS OF NEVADA,
National Weather Service, Reno, Nev. Weather Service Office.
For primary bibliographic entry see Field 07C.
W73-11218

PUBLIC PARTICIPATION IN URBAN WATER PLANNING,
Fort Lewis Coll., Durango, Colo.
For primary bibliographic entry see Field 06B.
W73-11257

THE ESTIMATION OF THE HYDROLOGICAL IMPACT OF URBANIZATION: AN EXAMPLE OF THE USE OF DIGITAL SIMULATION IN HYDROLOGY,
University Coll., London (England).
For primary bibliographic entry see Field 04C.
W73-11259

MOBILE AREA WATER TRANSPORTATION STUDY OF MOBILE, BALDWIN AND ESCAMBIA COUNTIES, ALABAMA.
Tippett Abbott McCarthy Stratton, New York.
For primary bibliographic entry see Field 08A.
W73-11260

RIVER SYSTEMS TRANSITION FUNCTION AND OPERATION STUDY,
New York State Dept. of Environmental Conservation, Albany. Bureau of Water Resources Planning.
C. Liu.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 99, No HY6, Proceedings paper 9806, p 889-900, June, 1973. 5 fig, 5 ref.

Descriptors: *Simulation analysis, *Reservoir operation, *River systems, *Hydraulics, *Water resources, *New York, Multiple-purpose projects, Management, Reservoir releases, Storage, Com-

puter programs, Flow, Streams, Diversion, Canals, Lakes, Mathematical models, Systems analysis, Equations.
Identifiers: *Oswego River System.

Presented is the mathematical basis of a reservoir-river systems operation, and its application to the systems conservation operations analysis. A relatively simple algorithm is developed to solve it. The 'level-number' technique is further extended to handle water reallocation schemes more flexibly. A completely general and flexible computer program which can be used to investigate a variety of management policies as well as various system configurations is developed as a result. A general and compact representation of the interaction of storage, release, and diversion operations is described. For any system configuration, the systems transition function has the same form; the difference between reservoir systems is reflected solely in the elements of the A matrix, the system configuration matrix, in the function. The systems conservation operation functions are derived from it and with relatively simple programming, the method can be applied to large scale systems conservation analysis. The storage reallocation method is formulated to handle linear and nonlinear operating rules. A multipurpose operation of the Oswego River System, a canal-river system with eight lakes, provides a case study for testing the computation procedures. (Bell-Cornell)
W73-11364

DISCRETE GRADIENT OPTIMIZATION OF WATER SYSTEMS,
Medical Univ. of South Carolina, Charleston. Dept. of Biometry.
For primary bibliographic entry see Field 08B.
W73-11365

PROBABILISTIC SHORT-TERM RIVER YIELD FORECASTS,
Washington Univ., Seattle. Dept. of Civil Engineering.
S. J. Burges, and A. E. Johnson.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol 99, No IR2, Proceedings paper 9785, p 143-155, June, 1973. 4 fig, 6 tab, 8 ref.

Descriptors: *Rivers, *River flow, *Streamflow forecasting, Hydrology, *Stochastic processes, *Regression analysis, *Inflow, Probability, Seasonal, Reservoir operation, Equations, Mathematical models, Systems analysis.

A predictive model, employing a first order autoregressive structure, which enables estimation of the probability distributions of streamflow volumes in future seasons, is developed. The model is applicable to streams that have intra-seasonal runoff volumes describable by lognormal probability distributions. A season long observation provides the initial value which is propagated through future seasons by the first order autoregressive streamflow volume structure. For high interseasonal (lag one) correlations, application of the model yields valuable forecasts for as many as ten time periods in the future, while for low correlations such forecasting is of no additional value after four time periods. The method has greatest utility for streams having high variability and distinct seasonality. (Bell-Cornell)
W73-11366

HYDROLOGIC RECORDS FOR VOLUSIA COUNTY, FLORIDA: 1971-72,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 07C.
W73-11399

HYDROLOGY AND WATER RESOURCES DEVELOPMENT IN NEPAL,
Geological Survey, Washington, D.C.

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control of Water on the Surface

W. W. Everett.

Available from NTIS, Springfield, Va 22131 as PB-212 035 Price \$3.00 printed copy; \$0.95 microfiche. Open-file report, June 1969. 104 p, 16 fig, 4 tab, 18 ref.

Descriptors: *Water resources, *Water resources development, *Foreign research, Surface waters, Groundwater, Hydrologic data, Streamflow, Water balance, Water yield.
Identifiers: *Nepal.

The water resources potential of Nepal were surveyed on a countrywide basis. By 1969, a nationwide network of hydrological stations had been established for the collection of streamflow, sediment and meteorological data, and groundwater exploration was started in the Terai Belt. Average annual runoff in Nepal is more than adequate to meet existing needs for basic water supply, and a large potential exists for hydropower and irrigation development from the rivers. During the monsoon season, from the middle of June to late September, flooding commonly occurs in low-lying areas. In the late dry season, March to the middle of June, runoff is deficient in many areas of the country. Tube wells are the more suitable approach to supplying irrigation requirements in the Terai Belt, at least in the near future. Factors that affect the overall development of the water resources potential of the river basins in Nepal are discussed in detail. (Knapp-USGS)
W73-11401

EFFECTS OF URBANIZATION ON FLOODS IN THE HOUSTON, TEXAS, METROPOLITAN AREA, Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 04C.
W73-11402

MATHEMATICAL METHODS IN THE THEORY AND PRACTICE OF MOUNTAIN STREAMFLOW COMPUTATION AND FORECASTING (MATEMATICHESKIE METODY V TEORII I PRAKTIKE RASCHETOV I PROGNOZOV STOKA GORNYKH REK).

Sredneaziatskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Tashkent (USSR).

Sredneaziatskii Regional'nyy Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut Trudy, No 1 (82), Yu. M. Denisov and Yu. N. Ivanov, editors, Leningrad, 1972. 208 p.

Descriptors: *Mathematical studies, *Rainfall-runoff relationships, *Mathematical models, *Mountains, *Streamflow forecasting, Model studies, Streamflow, Runoff, Floods, Hydrographs, Statistical models, Routing, Probability, Stochastic processes, Statistical methods, Correlation analysis, Regression analysis, Hydrologic data, Analytical techniques, Curves, Equations, Fluctuations.
Identifiers: USSR, Deterministic models, Stochastic models.

This collection contains 20 papers presented at the All-Union Symposium on the Use of Mathematical Methods in the Theory and Practice of Mountain Streamflow Computation and Forecasting, held in Tashkent, October 20-24, 1970. Deterministic and stochastic models are described in the application of hydrologic techniques to forecasting of runoff. (Josefon-USGS)
W73-11406

ECOLOGICAL AND PHYSIOLOGICAL IMPLICATIONS OF GREENBELT IRRIGATION - PHASE I, California Univ., Riverside. Dept. of Plant Sciences.
For primary bibliographic entry see Field 05D.
W73-11424

THE EFFECTS OF DITCHING ON THE MOSQUITO POPULATIONS IN SOME SECTIONS OF JUNCUS SALT MARSH IN CARTERET COUNTY, NORTH CAROLINA, North Carolina State Univ., Raleigh. Dept. of Entomology.

R. N. LaSalle, and K. L. Knight.

Available from the National Technical Information Service as PB-221 589, \$3.00 in paper copy, \$0.95 in microfiche. University of North Carolina Water Resources Research Institute Report No 82, June 1973. 162 p, 57 fig, 55 tab, 14 ref. OWRR B-27-NC (1), 14-31-0001-3316.

Descriptors: Mosquitoes, *Insect control, Vectors biological, Diptera, *Pest control, *North Carolina.
Identifiers: *Ditching, *Mosquito control.

Five areas of irregularly flooded salt marsh were studied to determine effects of ditching on mosquito populations. Principal species were Anopheles atropos Dyar and Knab, Anopheles bradleyi King, Aedes sollicitans (Walker) and Aedes taeniorhynchus (Weidemann). Present in lesser numbers were Culex salinarius Coquillett and Psorophora confinis (Lynch Arribalzaga). Data on both plant cover and on the abundance of mosquito larvae showed such wide variation in both ditched and unditch sections that no significant differences between sections could be detected. Aedes and Psorophora larvae were more commonly collected from sites marginal to marsh, whereas Anopheles and Culex were more evenly distributed throughout study areas. Percentage of Aedes and Psorophora larvae taken in samples tended to be directly proportional to mean slope of the breeding depression and inversely proportional to its frequency of flooding. Conversely, the relative abundance of Anopheles and Culex species was directly proportional to the frequency of flooding. Relative abundance of species in the ditched sites was more affected by the mean slope, frequency of flooding and the ratio of frequency of flooding/mean slope than in the unditch sections. (Howells-North Carolina)
W73-11431

THE EFFECT OF ENVIRONMENTAL FACTORS ON WOOD CHARACTERISTICS: I. THE INFLUENCE OF IRRIGATION ON PINUS RADIATA FROM SOUTH AUSTRALIA, J. W. P. Nicholls.

Silvae Genet. Vol 20, No 1/2, p 26-33, 1971. Illus.
Identifiers: *Australia (Mt. Crawford), Cells, Environmental studies, Fertilizers, Irrigation, *Pinus-Radiata-G, Tracheid, *Wood characteristics, Supplementary watering.

Specimens from 32 trees of *P. radiata* from 3 sites at Mt. Crawford were examined. Densitometric information and results for average tracheid length were collected from the last 10 successive growth rings in each tree. These data were analyzed to show the effect of supplementary watering and fertilizer treatment. The proportion of thickwalled cells associated with summer and autumn growth was increased from approximately 20% to 30%. Average tracheid length was not affected by supplementary watering. The changes in wood quality are not regarded as adverse and therefore the effect of the irrigation program is to increase the amount of acceptable wood.—Copyright 1972, Biological Abstracts, Inc.
W73-11452

PROGRESS REPORT OF RESIDUE STUDIES ON ORGANIC ARSENICALS USED FOR DITCHBANK WEED CONTROL, Bureau of Reclamation, Denver, Colo.
H. A. Salman, T. R. Bartley, and A. D. Summers. Bureau of Reclamation Report REC-ERC-72-37, Nov 1972. 8 p, 7 tab, 18 ref.

Descriptors: *Weed control, *Herbicides, Arsenic compounds, Chemical analysis, Irrigation canals,

Irrigation water, Water quality, Water analysis, Johnsongrass, Irrigation, Irrigation operation and maintenance, Irrigation systems, Bibliographies, Rio Grande River, On-site investigations.
Identifiers: *Rio Grande Project, Arsenic.

Monosodium methanearsonate (MSMA) was applied to the ditchbanks of full and dewatered irrigation systems on the Rio Grande Project to control ditchbank weeds and to determine the MSMA residues in irrigation water. Information obtained will provide support for the registration of organic arsenicals used for weed control along full and/or dewatered ditchbanks. Water samples were analyzed for total arsenic content after sulfuric-nitric acid digestion by the silver diethyldithiocarbamate method. Maximum arsenic concentrations found in the first water released through dewatered laterals were 0.54, 0.12, and 0.29 ppm, dropping below the mandatory US Public Health Service Drinking Water Standards for arsenic within 10 min. Maximum arsenic concentrations in full canal systems following MSMA herbicide application to ditchbanks were 0.16, 0.17, and 0.86 ppm, but dropped rapidly after a period of time. Test results show that low levels of arsenic occur in irrigation water for short periods of time following ditchbank applications of MSMA. Theoretical calculations indicate that from 0.002 to 0.04 lb of arsenic per acre per treatment could reach the farmland during a 24-hr period using 6 in. of irrigation water. (USBR)
W73-11497

THE IMPACT OF WEATHER MODIFICATION ON U.S. PLANNING FOR THE RIO COLORADO AND RIO GRANDE, Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 03B.
W73-11505

HYDRAULIC DESIGN OF STILLING BASIN FOR PIPE OR CHANNEL OUTLETS, Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 08B.
W73-11533

CITY OF ALBUQUERQUE SANDIA FOOTHILLS DRAINAGE, O'Brien (Ken) and Associates, Albuquerque, N. Mex.

October 1971. 128 p, 24 fig, 6 tab, 68 ref, 3 append.

Descriptors: *Drainage systems, *Evaluation, Technology, Environmental effects, Water rights, Infiltration, Pit recharge, Water spreading, New Mexico, Rio Grande River, Controlled drainage, Drainage water.
Identifiers: *Sandia Foothills (New Mexico).

Since 1952, several drainage studies have been performed for the East Mesa of Albuquerque, New Mexico. This study focuses on the alluvial fans at the base of the Sandia Mountains on the East Mesa, and covers an area of 1 mile by 5 1/2 miles. Several alternatives were examined including interception of the runoff to the Tijeras Arroyo through open channels and underground pipes, and the interception of all runoff for infiltration. This would involve the use of detention basins, spreading grounds, recharge wells, recharge pits and other facilities. These two major alternative systems were examined by considering technical, economic and environmental considerations. The system to divert the water to the Tijeras Arroyo was favored because: (1) technically, it was felt to be more reliable than the capturing and infiltration of runoff; (2) economically, it would have a lower initial cost; and (3) environmentally, infiltration of runoff presented problems of possible ground water contamination. There is the possibility of perched water tables in conjunction with spread-

WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Groundwater Management—Group 4B

ing grounds and recharge pits, and recharge wells present the possibility of causing earthquake activity. Furthermore, New Mexico is a member of the Rio Grande Water Compact, and any water which is diverted from its normal flow to the Rio Grande would have to be replaced, and infiltration holds no real advantage in providing water supplies to the area. (See also W73-11669) (Poertner) W73-11668

SUPPLEMENT TO CITY OF ALBUQUERQUE SANDIA FOOTHILLS DRAINAGE STUDY.

O'Brien (Ken) and Associates, Albuquerque, N. Mex.

March 1972. 31 p, 3 fig, 1 tab.

Descriptors: *Drainage systems, *Evaluations, *Flood control, *Infiltration, Controlled drainage, Economics, Environmental effects, Groundwater pollution, New Mexico, Flooding, Recharge, Recharge ponds, Pit recharge, Land forming, Water management (Applied).

Identifiers: *Albuquerque (New Mexico), Sandia Foothills.

The proposed drainage requirements of the Albuquerque Metropolitan Arroyo Flood Control Authority were examined to determine their general effectiveness and their effect on drainage system suggestions made previously for the Sandia Foothills in Albuquerque. In the previous study (See W73-11668) it was recommended that a system of open channels and underground pipes be used to convey the runoff to an outlet instead of retaining the water for infiltration. However, the proposed flood control authority policy and the basic strategy of reducing flooding by detaining and infiltrating runoff rather than disposing of it quickly. Limits were set on the maximum impervious area, and developments are to provide areas for the infiltration of all runoff from impervious areas, including rooftops, paved areas and streets. Design is to be based on the 100-year storm runoff, and infiltration areas could be used as open space recreational areas and be dedicated to the City. Many of the proposed requirements were based on worthwhile motives, but there were serious objections. The infiltration of urban runoff could cause serious pollution problems. Also, the requirements would make maintenance the responsibility of the private owner, and might be neglected. The proposed changes were more costly than the alternative drainage system—from \$330,000 to \$1 million more than the original cost of \$3.68 million. (Poerner)

W73-11669

REDUCTION OF HYDRAULIC SEWER LOADINGS BY DOWNSPOUT REMOVAL,

Springfield Sanitary District, Ill.

G. L. Peters, and A. P. Troemper.

Journal of the Water Pollution Control Federation, Vol 41, No 1, p 63-81, January, 1969. 12 fig, 7 tab.

Descriptors: *Flood control, *Sewerage, Storm water, Storm runoff, Controlled drainage, Storm drains, Urban drainage, Drainage systems, Sewers, Drainage programs, Drainage engineering, Drainage water, Water management (Applied), Roofs.

Identifiers: *Roof drain removal.

The removal of roof drains from the sewer system can markedly reduce sewer loading and flooding. Realizing this, the Springfield Sanitary District had an ordinance in effect since 1926 to prohibit such connections. However, there was no enforcement of this ordinance, and the problems of sewer overloading and flooding became worse. In 1948, a program was developed for the removal of these roof drains. But geographical limitations on the authority of the District prevented any real progress against the major problems of flooding in the city. A 1963 act of the Illinois Legislature ex-

panded the authority of the Sanitary District and a new downspout removal program was begun in April of 1966, to last for 2 full years. The city was divided into districts and all buildings were checked by inspectors. During inspection, it was assumed that all drains discharging underground were illegal connections. After inspecting 25,527 buildings, 40 percent were found to be in violation. These people were sent letters advising them of their violation and suggested methods of compliance. Second inspections were made and initial compliance was over 50 percent. Further letters implying legal action and appeal to public spirit were sent. Eventually, all but 5 percent of all buildings complied with the law. Some of these were allowed to retain their connections because of hardship cases. The cost of removal in most cases was estimated at \$5 to \$100. The program was deemed very effective, not only in reducing flooding but, also, for reducing the amount of water put through the sewage treatment plant. (Poerner) W73-11671

4B. Groundwater Management

GROUND WATER RECHARGE THROUGH PITS AND WELLS,

Kansas Water Resources Research Inst., Manhattan.

H. L. Manges.

Available from the National Technical Information Service as PB-221 329, \$4.75 in paper copy, \$0.95 in microfiche. Contribution Number 82, May 1973. 43 p, 10 fig, 5 tab, 29 ref. OWRR A-021-KAN (2). 14-01-0001-1084.

Descriptors: *Groundwater recharge, *Pit recharge, *Recharge wells, *Filtration, Drainage, Hydrology, Aquifers, Aquifer characteristics, Water treatment, Water purification, Water resources, *Kansas.

Identifiers: *Filter fabrics.

Well water was successfully recharged to the Meade formation in Southcentral Kansas through a pit and a well. However, when surface runoff water was recharged, the surface of the pit became sealed over for all practical purposes and the specific capacity of the well was reduced from 44 to 31 gallons per minute per foot of drawdown. Recharging of the aquifer appears feasible provided the water is of high quality. In laboratory filtration studies, the turbidity of a slurry made up from tap water and topsoil was lowered from 30 to less than 10 Jackson Turbidity Units (JTU) by passing it through filter cloths. The filter cloth served only as a septum upon which a cake formed and the turbidity was reduced by the forming filter cake. Flow rates after 24 hours varied from 0.10 to 0.34 gallons per minute per square foot and are comparable to flow rates through slow sand filters. (W73-11053)

GROUNDWATER DATA IN THE CORVALLIS-ALBANY AREA, CENTRAL WILLAMETTE VALLEY, OREGON,

Geological Survey, Portland, Oreg.

F. J. Frank, and N. A. Johnson.

Oregon State Engineer Groundwater Report No 17, November 1972. 46 p, 3 fig, 3 tab, 11 ref.

Descriptors: *Groundwater resources, *Water wells, *Well data, *Oregon, *Basic data collections, Water level fluctuations, Aquifers, Drillers logs, Pumping, Water yield, Drawdown, Water utilization, Water quality, Chemical analysis, Hydrographs, Maps.

Identifiers: *Corvallis-Albany area (Oreg), Central Willamette Valley (Oreg).

Basic records of representative existing wells, water levels, and chemical quality of groundwater are presented for the Corvallis-Albany area,

Oregon. Most of the high-yield wells produce water from alluvial (sand and gravel) aquifers that underlie the main valley plain or that are coextensive with the present flood plain of the Willamette River. Hydrographs show fluctuations of water levels during 1962-72 in nine selected wells. Water levels are highest during the wet winter and spring months and lowest during the dry summer and autumn months. Well data are tabulated for 415 representative wells whose locations are shown on a map. Most of the data were obtained from well-drillers' reports submitted to the office of the Oregon State Engineer; some of the data were supplied by the well owners or operators. Chemical analyses are tabulated for water samples from 27 wells. Water analyses for 21 wells were made by the U.S. Geological Survey and the rest by commercial or State laboratories. (Woodard-USGS) W73-11093

GROUNDWATER REGIME IN THE ZONE OF INFLUENCE OF PUMPING (REZHIM GRUNTOVYKH VOD V ZONE VLIYANIYA VERTIKAL'NOGO DRENAZHA),

Bukharskaya Selskokhozyaistvennaya Opytnaya Stanitsiya (USSR)

A. G. Kim.

Gidrotekhnika i Melioratsiya, No 6, p 74-76, June 1971. 4 fig.

Descriptors: *Groundwater, *Pumping, Water table, Water level fluctuations, Leaching, Salts, Wells, Observation wells, Curves.

Identifiers: *USSR (Bukhara Oblast).

The groundwater regime in the zone of influence of pumping was investigated in 1967-68 at the Kagan State Farm, Kagan Rayon, Bukhara Oblast. The groundwater regime was studied in a test area covering 450 hectares and containing 5 wells dug to a depth of 25 m and equipped with perforated pipes 325 mm in diameter. Groundwater level measurements were made at 37 observation wells every 5-10 days and daily during leaching to remove salts. Groundwater levels were also measured in the spring and fall at 68 temporary observation wells. Depth of groundwater occurrence in the zone of influence is 1 m greater than in an unaffected area. Deep occurrence of groundwater in the zone ensures adequate leaching of salts from the soil and reduces the salinity hazard. With a well discharge of 20 liter/sec, pumping effects extend over a distance of 300 m, and groundwater within the radius of influence remains consistently at a depth of 440-510 cm. (Josefson-USGS) W73-11094

GROUND WATER IN FINNEY COUNTY, SOUTHWESTERN KANSAS,

Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 07C.

W73-11106

GROUNDWATER LEVELS IN NEBRASKA, 1972,

Geological Survey, Lincoln, Nebr.

M. J. Ellis.

Nebraska Water Survey Paper No 34, May 1973. 93 p, 10 fig, 1 tab.

Descriptors: *Groundwater, *Water levels, *Water wells, *Nebraska, Basic data collections, Hydrogeology, Water level fluctuations, Water utilization, Withdrawal, Irrigation, Aquifer characteristics, Water supply, Groundwater recharge.

During 1972 the installation of irrigation wells in Nebraska continued at an active rate. Holt County, with 148 wells, again led other counties, followed by Custer County with 84 wells and Hamilton County with 90 well installations. Adams, Antelope, Boone, Buffalo, Clay, Frontier, Hall, Kearney, Merrick, Phelps, Red Willow, and York

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B—Groundwater Management

Counties increased their number of wells by 50 or more. The cumulative total number of registered irrigation wells in the State through 1972 is 39,505. The following information is given for each well in the Statewide network of water-level observation wells: year of the earliest recorded water level; highest and lowest recorded water levels, in feet below land surface; a fall 1972 water-level measurement, in feet below land surface; the departure, in feet, of the fall 1972 water level from an assumed normal water level; and the change from previous fall, or net difference, in feet, between the fall 1972 and fall 1971 water-level measurements. (Woodard-USGS)
W73-11120

BEHAVIOR OF GROUNDWATER FLOW SUBJECT TO TIME-VARYING RECHARGE,
Water Resources Engineers, Inc., Springfield, Va.
For primary bibliographic entry see Field 02F.
W73-11142

GEOLOGY AND GROUND-WATER CHARACTERISTICS OF THE HANFORD RESERVATION, THE U.S. ATOMIC ENERGY COMMISSION, WASHINGTON,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W73-11204

STREAM DEPLETION FACTORS, ARKANSAS RIVER VALLEY, SOUTHEASTERN COLORADO: A BASIS FOR EVALUATING PLANS FOR CONJUNCTIVE USE OF GROUND AND SURFACE WATER,
Geological Survey, Lakewood, Colo.

Open-file report, November 1972. 8 p, 5 fig, 4 map, 1 tab, 12 ref.

Descriptors: *Water resources development, *Surface-groundwater relationships, *Withdrawal, *Groundwater recharge, *Colorado, Watershed management, Water utilization, Analog models, Mapping, Streamflow forecasting, Maps, Hydrology, Hydrogeology.
Identifiers: *Arkansas River Valley (Colo).

The Arkansas River valley in Colorado is a stream-aquifer system that consists of the Arkansas River and the associated valley-fill deposits. The history of delivery of irrigation water by canals indicates that the supply has been inadequate during some seasons and some years. The shortage can be reduced by carefully designed conjunctive use of ground and surface water. An analog model of the Arkansas River valley in Colorado was constructed to facilitate such designs (Moore and Wood, 1967). The purpose of this report is to make hydrologic maps available to water managers and planners. The maps are useful for estimating the changes in streamflow caused by recharge to or withdrawal of ground water from the valley-fill aquifer between Pueblo, Colo., and the Kansas State line. Use of maps and a concept described will assist planners and managers in their task of providing timely delivery of water to the users and in the administration of water laws. (Woodard-USGS)
W73-11221

WATER RESOURCES OF HEMPSTEAD, LAFAYETTE, LITTLE RIVER, MILLER, AND NEVADA COUNTIES, ARKANSAS,
Geological Survey, Washington, D.C.
A. H. Ludwig.

Available for sale by GPO, Washington, D.C. 20402, Price \$4.00. Water-Supply Paper 1998, 1972. 41 p, 9 fig, 5 plate, 10 tab, 23 ref.

Descriptors: *Water resources, *Groundwater resource, *Surface waters, *Hydrologic data, *Arkansas, Basic data collections, Water wells,

Aquifer characteristics, Water yield, Streamflow, Flow rates, Water quality, Chemical analysis, Hydrogeology, Water utilization, Water supply, Low-flow frequency, Flood frequency, Water levels.

Identifiers: *Red River Valley (Ark), Hempstead County (Ark), Lafayette County (Ark), Little River County (Ark), Miller County (Ark), Nevada County (Ark).

The five-county area in southwest Arkansas that consists of Hempstead, Lafayette, Little River, Miller, and Nevada Counties possesses abundant water resources. Nearly all water supplies are obtained from groundwater. Surface water is used primarily for municipal supply at Texarkana and for industrial supply at a papermill near Ashdown. The aquifers of Cretaceous age are the principal sources of freshwater in northern Hempstead and Nevada Counties, where wells yield as much as 300 gpm of good quality water from depths as great as 1,200 feet. Aquifers of Tertiary age are good sources of water in Miller and Lafayette Counties and in southeastern Nevada County. Terrace deposits of Quaternary age are good sources of water in Little River and Lafayette Counties. The Red River is the largest source of surface water in the project area. It drains about 48,000 square miles upstream from the area and has an average flow of 12,180 cfs. The principal reservoirs in the area are Millwood Reservoir on Little River (capacity, 1,858,000 acre-feet) and Lake Erling on Bodcau Creek (capacity, 49,000 acre-feet). More than 5,500 lakes and farm ponds of 5 acres or less have a combined storage capacity of more than 14,000 acre-feet. Water in the Red River is high in chloride and dissolved solids and, consequently, is chemically unsuitable for most uses unless treated. (Woodard-USGS)
W73-11222

SCOPE OF PUBLIC WATER SUPPLY NEEDS.
New York State Temporary Commission on the Water Supply Needs of Southeastern New York, Albany.
For primary bibliographic entry see Field 06D.
W73-11245

EMERGING WATER SUPPLY TECHNOLOGY.
New York State Temporary Commission on the Water Supply Needs of Southeastern New York, Albany.
For primary bibliographic entry see Field 03D.
W73-11246

ARTIFICIAL RECHARGE OF GROUND-WATER, A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C.

Available from the National Technical Information Service as PB-221 479, \$3.00 in paper copy, \$0.95 in microfiche. Water Resources Scientific Information Center Report WRSIC 73-202, February 1973. 309p.

Descriptors: *Artificial recharge, *Bibliographies, *Groundwater recharge, *Pit recharge, *Recharge wells, Aquifers, Conjunctive use, Injectivity wells, Reclaimed water, Saline water intrusion, Water management (Applied), Water reuse, Withdrawal.

This report, containing 210 abstracts, is another in a series of planned bibliographies in water resources to be produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the data base had 50,631 abstracts covering SWRA through December 15, 1972 (Volume 5, Number 24). Author and subject indexes are included. (OWRR)
W73-11321

WATER RECORDS OF THE U.S. VIRGIN ISLANDS, 1962-69,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W73-11396

GROUND-WATER BASIC DATA OF CAVALIER AND PEMBINA COUNTIES,
Geological Survey, Bismarck, N. Dak.
R. D. Hutchinson.
North Dakota Geological Survey Bulletin 62, Part II, and North Dakota Water Commission County Ground-Water Studies 20, Part II, 1973. 606 p, 29 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, *Water yield, *Water quality, *North Dakota, Water utilization, Hydrologic data, Basic data collections, Water wells, Well data, Chemical analysis, Water supply, Municipal water, Domestic water, Livestock, Industrial water, Irrigation water.
Identifiers: *Cavalier and Pembina Counties (N Dak).

The purpose of the hydrologic investigation in Cavalier and Pembina Counties, N. Dak., was to determine the quantity and quality of groundwater available for municipal, domestic, livestock, industrial, and irrigation uses. Specifically, the objectives were: (1) determine the location, extent, and nature of the major aquifers; (2) evaluate the occurrence and movement of groundwater, including the sources of recharge and discharge; (3) estimate the quantities of water stored in the aquifers; (4) estimate the potential yields to wells tapping the major aquifers; and (5) determine the chemical quality of the groundwater. The information was collected chiefly between 1968 and 1971, and contains: (1) geologic and hydrologic data for 2,286 wells, test holes, and springs; (2) water level measurements in 125 observation wells; (3) lithologic and geophysical logs of about 886 test holes and wells; (4) chemical analyses of 296 water samples; (5) particle-size analyses of material from various aquifers; and (6) the hydraulic conductivity of materials from various depths and locations. (Woodard-USGS)
W73-11397

HYDROLOGIC RECORDS FOR VOLUSIA COUNTY, FLORIDA: 1971-72,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 07C.
W73-11399

HYDROLOGY AND WATER RESOURCES DEVELOPMENT IN NEPAL,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04A.
W73-11401

HYDROLOGY OF TRUCKEE MEADOWS, NEVADA,
Nevada Univ., Reno, Desert Research Inst.
R. L. Cooley, J. W. Fordham, and J. A. Westphal.
Available from the National Technical Information Service as PB-221 539, \$3.00 in paper copy, \$0.95 in microfiche. Nevada Water Resources Research Institute, Reno, Project Report No 15, October 1971. 49 p, 6 fig, 4 plate, 4 tab, 17 ref, 1 append. OWRR A-034-NEV (1).

Descriptors: *Water resources, *Hydrology, *Irrigation water, *California, *Nevada, Governments, Surface waters, Groundwater, Water quality, Water demand, Water supply, Watershed management, Model studies, Hydraulic models.
Identifiers: *Truckee Meadows (Nev).

The States of California and Nevada and the federal government are involved in the fate of Pyramid Lake and the Newlands Irrigation pro-

WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Effects on Water of Man's Non-Water Activities—Group 4C

ject. Truckee Meadows, which lies at the base of the Carson Range (a spur of the Sierra Nevada) approximately 30 miles northeast of Lake Tahoe, was studied with regard to its potential as a source for additional water for the system. Using the groundwater model, groundwater inflow to the Meadows from areas peripheral to the basin was estimated to be about 5,000 acre-feet per year (ac-ft/yr). However, using reasonable extremes for transmissivities, the model indicates inflow could range from 2,000 to 8,000 ac-ft/yr. The estimated recharge rate includes underflow from tributary valleys, recharge on alluvial fans and slopes, and underflow from the bordering mountain ranges. Underflow out of Truckee Meadows occurs in the vicinity of Vista and is apparently less than 10 ac-ft/yr. Mining groundwater in the Meadows would yield about 2 feet of water per 10 feet of saturated material per unit area based on an estimated average specific pumping carries several risks which could overshadow any benefits. Lowering water levels in areas of groundwater discharge will increase hydraulic gradients toward the discharge areas and will likely induce movement of poorer quality water into pumpage areas. (Woodard-USGS)
W73-11430

OXYGEN—A MAJOR ELEMENT IN DRILL PIPE CORROSION,
Shell Development Co., Houston, Tex.
For primary bibliographic entry see Field 08G.
W73-11453

CORROSION OF METALS IN TROPICAL ENVIRONMENTS—COPPER AND WROUGHT COPPER ALLOYS,
Naval Station, Canal Zone. Fuel Div.
For primary bibliographic entry see Field 08G.
W73-11455

TYPICAL LOG-CURVE SHAPES INDICATE FORMATION CHARACTERISTICS,
Dresser Industries, Inc., Houston, Tex.
For primary bibliographic entry see Field 08A.
W73-11456

OIL FIELD TECHNIQUES USED TO INCREASE FLOW IN COMMUNITY WATER WELL,
For primary bibliographic entry see Field 08A.
W73-11465

OPTIMUM HOLE DIAMETER FOR WATER WELLS,
For primary bibliographic entry see Field 08A.
W73-11468

SALINITY CONTROL ON A BOREHOLE SOURCE IN BUNTER SANDSTONE,
East Shropshire Water Board (England).
A. E. J. Edwards.
Institution of Water Engineers Journal, Vol 26, No 3, p 170-174, May 1972. 2 fig, 1 tab.

Descriptors: Saline water, Wells, Water wells, *Salinity, Chlorides, Sandstones, Logging (Recording), Municipal water, Water supply development, *Water yield improvement, Water sampling pumping.
Identifiers: Great Britain, *Salinity control.

Investigations into methods of reducing the high salinity of water abstracted from a borehole source are outlined. Auxiliary scavenger pumps were adopted as a solution and have resulted in a 55% reduction of the chloride content in the normal station output of 5450 cu. m/day. A gradually increasing abstraction had been accompanied by an increasing chloride content; by 1965, it had become obvious that further abstraction increases would only be possible if accompanied by remediation.

al measures to reduce the level of chlorides put into supply. Some data on the pattern of inflow of saline water were gathered by investigations during 1965-1967. A solution based on these data was the installation of 'scavenger' pumps below the suction level of the main supply pumps, to abstract the high chloride water to waste. The scavenging system has proved most successful; regular sampling over the two-year period after installation has shown that low chloride levels can be maintained. (Smith-NWWA)
W73-11469

ARTIFICIAL RECHARGE IN THE WHITEWATER RIVER AREA, PALM SPRINGS, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.

S. J. Tyley.
Geological Survey open-file report, January 30, 1973. 51 p, 18 fig, 10 tab, 18 ref.

Descriptors: *Artificial recharge, *Groundwater recharge, *Imported water, *Aquifer characteristics, *California, Colorado River, Water chemistry, Hydrogeology, Infiltration, Mixing, Aquifers, Water wells, Well data, Drillers logs, Hydrologic data, Water quality.
Identifiers: *Palm Springs area (Calif.).

Water levels in the Palm Springs, California, area declined as much as 75 feet from 1945 to 1970. To relieve this overdraft the two primary agencies responsible for water supply to the area, the Coachella Valley County Water District and the Desert Water Agency, contracted with the State of California to begin in 1973 to purchase water imported through the California Aqueduct. A study in the area revealed that the percolation basin method seems to be the most feasible way to recharge the proposed 61,000 acre-feet per year of imported Colorado River water in the Whitewater River area north of Palm Springs. The Windy Point area provides the most logical artificial recharge sites. No significant clay or silt layers exist in the alluvial fill to impede the downward movement of artificially recharged water to the water table. Infiltration rates in the Windy Point area ranged from 4 to 24 feet per day. A realistic long term average infiltration rate would be about 5 feet per day. Mixing in the aquifer system of the Colorado River water with native surface water and groundwater should have no detrimental effects on infiltration rates. The quality of the groundwater as affected by artificial recharge will depend on the ratios of quality and quantity of imported to local recharge water and on the degree to which the artificially recharged water mixes with the native water. (Woodard-USGS)
W73-11113

development, Sediment control, Reservoirs, *Sediment yield, Storm runoff, Particle size, Data collections, Geology, Topography, Water quality, Environmental effects.
Identifiers: Sediment-retention reservoirs.

The average annual rate of suspended-sediment discharge of the Stony Brook at Princeton, N.J. (44.5 square miles) is about 8,800 tons, or 200 tons per square mile. Annual yields within the basin, which is located in the Piedmont Lowlands section of the Piedmont physiographic province in western New Jersey, range from 25 to 400 tons per square mile. Storm runoff that transports suspended materials in excess of a ton carries 90% of the total suspended-sediment discharge from the basin. The suspended material carried during storms is about 55% silt, 40% clay, and 5% sand. Variations in sediment during the study (1956-70) are attributed to the integrated influence of several factors. A 2.9% decrease in croplands and an increase of 5.1% in idle and urban land use probably produced a net increase in sediment yields. Construction of seven sediment-retention reservoirs resulted in temporary increases in sediment yields. However, based on a trap-efficiency investigation at one site, the combined effect of operation of these seven reservoirs is estimated to result in a 20% reduction in sediment discharge from the basin. (Woodard-USGS)
W73-11113

ANNUAL COMPILED AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE FORT WORTH, TEXAS, METROPOLITAN AREA, 1971,
Geological Survey, Fort Worth, Tex.
B. B. Hampton.
Geological Survey Texas District open-file report, 1973. 77 p, 3 fig, 5 tab.

Descriptors: *Urbanization, *Urban hydrology, *Urban runoff, *Hydrologic data, *Texas, Floods, Flood frequency, Flood discharge, Environmental effects, Rainfall-runoff relationships, Basic data collections, Streamflow, Flow rates, Stream gages, Sediment transport, Turbidity, Hydrographs, Mass curves.
Identifiers: *Fort Worth area (Tex.).

In October 1968, the Geological Survey in cooperation with the city of Fort Worth, Texas, Department of Public Works began a program of hydrologic investigations on several small streams in Fort Worth. The investigations are designed to evaluate factors affecting floods on small streams in the metropolitan area. Studies of additional streams, one of which drains beneath the impervious area of a shopping center, were added to the program in October 1969. The objectives are to (1) determine, on the basis of historical data and hydrologic analyses, the magnitude and frequency of floods; (2) document and define the areal extent of floods of greater than ordinary magnitude; and (3) determine the effect of urban development on flood peaks and volume. This report is the third in a series published annually for the Fort Worth area as part of a continuing program. The report presents the basic-hydrologic data collected in four study areas during the 1971 water year (October 1, 1970 to September 30, 1971). The four study areas within the metropolitan area are Sycamore Creek, Sycamore Creek tributary, Dry Branch, and Little Fossil Creek. The Sycamore Creek tributary study area includes the highly impervious area of the Seminary South Shopping Center as a subarea. (Woodard-USGS)
W73-11213

FINANCING PRIVATE WATER RESOURCE DEVELOPMENT: ANALYSIS OF A STATE LOAN PROGRAM,
Wyoming Univ., Laramie. Div. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W73-11686

4C. Effects on Water of Man's Non-Water Activities

EFFECTS OF LAND USE AND RETENTION PRACTICES ON SEDIMENT YIELDS IN THE STONY BROOK BASIN, NEW JERSEY,
Geological Survey, Washington, D.C.
L. J. Mansue, and P. W. Anderson.
Open-file report, 1973. 48 p, 11 fig, 8 tab, 21 ref.

Descriptors: *Sediment transport, *Land use, *New Jersey, *Urbanization, Agriculture, Land

QUALITATIVE VALUES IN ENVIRONMENTAL PLANNING: A STUDY OF RESOURCE USE IN URBANIZING WATERSHEDS,
Harvard Univ., Cambridge, Mass., Dept. of Landscape Architecture.
For primary bibliographic entry see Field 05G.
W73-11233

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4C—Effects on Water of Man's Non-Water Activities

URBANIZATION'S DRAINAGE CONSEQUENCE,
Nolte (George S.) and Associates, San Jose, Calif.;
and San Diego County Comprehensive Planning
Organization, Calif.

P. O. Reimer, and J. B. Franzini.

Journal of the Urban Planning and Development
Division, American Society of Civil Engineers,
Vol 97, No UP2, p 217-237, December, 1971. 6 fig.
5 tab, 5 ref, 3 append.

Descriptors: *Flood control, *Channel improvements,
*Computer programs, Flood plains, Urban
land use, Watersheds (Basins), Cost comparisons,
*California.

Identifiers: *Flood plain management, San Diego
County (Calif), Los Coches Creek (Calif).

A computer methodology for the preliminary costing of flood control facilities based on alternative land use patterns in a watershed is presented in this article. The computer program, called URB DRA CONS, enables rapid determination of flood flows and the costs of channel improvements required to accommodate these flows given different land use patterns and levels of flood protection. The planner can use the program to quickly test various urban patterns, to define flood plain limits, and to compare the cost of flood plain acquisition to channel improvement. The methodology consists of three basic programs: one to compare the outflow from sub-basin areas, one to relate flows of sub-areas and main channels to water-surface elevations or stage levels, and one to estimate the cost of channel improvements to achieve specified water elevations. The programs have been applied in a pilot study for the Los Coches Creek watershed in San Diego County. Several maps and tables from this application are included as well as appendices describing the program procedures in detail. The pilot study has renewed attention to flood plain planning in San Diego County. (Elfers-North Carolina)

W73-11254

THE ESTIMATION OF THE HYDROLOGICAL IMPACT OF URBANIZATION: AN EXAMPLE OF THE USE OF DIGITAL SIMULATION IN HYDROLOGY,

University Coll., London (England).

G. E. Hollis.

February, 1970. 24 p, 9 fig, 3 tab, 35 ref.

Descriptors: *Urbanization, *Hydrologic models,
*Computer simulation, Hydrology, Hydrologic
data, Environmental effects, Watersheds, Runoff,
Land use.

Identifiers: Canon's Brook, England.

Changing land uses due to urbanization have a significant effect on the hydrologic cycle of a watershed. This paper presents a study of the effect of urbanization in a small watershed in England, Canon's Brook. Since the data from the watershed was not ideal and conventional evaluation methods such as double mass, trend analysis, and multiple regression analysis have limitations, the study developed a computer simulation model to predict runoff flows. The simulation model incorporates such factors as interception, infiltration, and evapotranspiration. The inputs include daily values of precipitation, monthly values of sunshine, temperature, and wind speed. The output from the model is the predicted monthly runoff. Results have shown that while winter runoff has increased only slightly, summer and autumn runoff has increased five fold. Although the simulation model is able to overcome various data problems it also has some limitations and these are evaluated in relation to the results of the study. (Eifers-North Carolina)

W73-11259

THE EFFECT OF AFFORESTATION ON STREAMFLOW AT CATHEDRAL PEAK: REPORT NO. 1,
Forest Research Inst., Pretoria (South Africa).

U. W. Nanni.

Identifiers: Cathedral Peak Forest (So Afr),
*Forestation effects, *Pinus-Patula-G, Runoff,
*South Africa, Stream flow.

Streamflow from the first catchment which was afforested at the Cathedral Peak Forest Influences Research Station has decreased since afforestation. The decrease became evident when the Pinus patula trees, which were planted on 74% of the area, were 8 yr old. By the age of 17 yr, the annual decrease for the area afforested was 508 mm and appeared to have leveled off.—Copyright 1972, Biological Abstracts, Inc.

W73-11310

EFFECTS OF URBANIZATION ON FLOODS IN THE HOUSTON, TEXAS, METROPOLITAN AREA,

Geological Survey, Austin, Tex.

S. L. Johnson, and D. M. Sayre.

Available from NTIS, Springfield, Va 22151 as PB-220 751 Price \$3.00 printed copy; \$0.95 microfiche. Water-Resources Investigations Report 3-73, April 1973. 50 p, 7 fig, 9 tab, 15 ref.

Descriptors: *Urban hydrology, *Floods, *Urban runoff, *Runoff forecasting, *Rainfall-runoff relationships, Flood control, Gaging stations, Peak discharge, Urbanization, Environmental effects, Regression analysis, Indirect flood measurement, Correlation analysis, Hydrologic data.

Identifiers: *Houston (Texas), Urbanization runoff increase.

Runoff data from drainage basins in the Houston, Texas, metropolitan area and a 50-year rainfall record for the National Weather Service Station, Houston-City, were used to simulate 60 annual flood peaks at 26 sites. Selected frequency characteristics, based on these simulated annual peaks, are related to drainage area and percentage of impervious area. The relationships indicate that as urbanization increases the impervious surface from 1 to 35%, the magnitude of a 2-year peak is increased by a factor of 9, and the magnitude of a 50-year peak is increased by a factor of 5. Other analyses indicate that urbanization also significantly increases the magnitude of annual runoff. (Woodard-USGS)

W73-11698

ECOLOGICAL MONITORING OF TWO BEACH NOURISHMENT PROJECTS IN BROWARD COUNTY, FLORIDA,

Florida Atlantic Univ., Boca Raton. Dept. of Zoology.

For primary bibliographic entry see Field 02J.

W73-11528

CLIMATE CHANGE AND THE INFLUENCE OF MAN'S ACTIVITIES ON THE GLOBAL ENVIRONMENT,

National Center for Atmospheric Research, Boulder, Colo.

For primary bibliographic entry see Field 02A.

W73-11562

EFFECTS OF LOGGING ON PERiphyton IN COASTAL STREAMS OF OREGON,

New Mexico Univ., Albuquerque. Dept. of Biology.

For primary bibliographic entry see Field 05C.

W73-11582

URBAN HYDROLOGY FOR THE PERIOD UP TO DECEMBER 1971.

National Water and Soil Conservation Organization, Wellington (New Zealand).

Hydrological Research Annual Report No 24, 1972. 21 p, 16 fig, 2 tab, 1 ref, 2 append.

Descriptors: *Urbanization, *Urban hydrology,
*Storm runoff, *International Hydrological Decade, Projects, Hydrologic data, Data collections, Watershed management, Land use, Precipitation (Atmospheric), Streamflow, Flood frequency, Peak discharge, Foreign countries.

Identifiers: *New Zealand, *Manukau (New Zealand).

Under the auspices of the International Hydrological Decade the Ministry of Works is establishing a network of experimental basins to study the hydrological characteristics of important soil and vegetation complexes of New Zealand. The study of the effect of cultural change on these characteristics is also included. This paper is on the Manukau City Experimental basin in which the hydrological effects of urbanization are studied. Included are reports of related studies in urban hydrology which are carried out near the experimental basin. Research is coordinated by the National Water and Soil Conservation Organization and is carried out in conjunction with other organizations. Ultimately it is hoped that experimental basins will be established in New Zealand. The study includes the influence of urbanization on flood peak discharges and flood volumes in particular and on the hydrological regime in general; data for developing and testing a mathematical model for the prediction of flood peak discharges for urban catchments under New Zealand conditions; data for refining existing urban stormwater drainage design techniques; and design data to assist in the solution of particular stormwater design problems within the catchments being studied. (Woodard-USGS)

W73-11698

EFFECTS OF ROADWAY AND POND CONSTRUCTION ON SEDIMENT YIELD NEAR HARRISBURG, PENNSYLVANIA,

Geological Survey, Harrisburg, Pa.

For primary bibliographic entry see Field 02J.

W73-11700

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

PLANT ANALYSIS FOR NUTRIENT ASSAY OF NATURAL WATERS,

Wisconsin Univ., Madison. Dept. of Botany; and Wisconsin Univ., Madison. Inst. of Plant Development.

For primary bibliographic entry see Field 05C.

W73-11057

FLUORESCENT PROBES IN THE DETECTION OF INSECTICIDES IN WATER,

Georgia Univ., Athens. Dept. of Entomology.

C. M. Himel.

Copy available from GPO Sup Doc as EPI.23/2:73-217, \$0.75; microfiche from NTIS as PB-221 336, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-217, April 1973. EPA Project 16020 EAO.

Descriptors: *Fluorescence, *Insecticides, Water pollution, *Pollutant identification, Analytical techniques, Methodology, *Enzymes.

Identifiers: *Fluorescent probes, Cholinesterase enzymes.

Objectives included synthesis of candidate fluorescent probe molecules for cholinesterase enzymes and evaluation of the feasibility of developing a new analytical method for insecticides in water. This was accomplished. Results with Durban, Thioden and certain other insecticides are in the range of 1X10-7M. Insecticides which do not

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

compete with, or displace the probe from its complex are not detected. Experimental parameters for design and synthesis of optimum probe molecules were developed. (EPA) W73-11061

NEUTRON ACTIVATION ANALYSIS OF BOTTOM SEDIMENTS,
Environmental Protection Agency, Athens, Ga.
Southeast Water Lab.
R. V. Moore, and O. W. Propheter.
Copy available from GPO Sup Doc as
EP1.23/2.73-009, \$0.40; microfiche from NTIS as
PB-221 339, \$0.95. Environmental Protection
Agency, Technology Series Report EPA-R2-73-
009, March 1973. 16 p, 2 tab, 7 ref. EPA Project
16202 GHQ.

Descriptors: *Trace elements, *Bottom sediments, *Neutron activation analysis, Analytical techniques, Pollutant identification, Water pollution.
Identifiers: Ge (Li) detector.

Instrumental neutron activation analysis (INAA) was applied to bottom sediments obtained from 17 locations (small and large rivers, a canal, coastal waters, and a bay) within the United States to determine the applicability of INAA to water pollution studies. Irradiations of 30 seconds and 60 minutes, followed by three pulse-height analyses of gamma radiation, detected and measured up to 43 elements including most elements of interest. Decay times did not exceed seven days. Sample handling was minimal. Elements readily analyzed are Al, As, Ba, Mg, Dy, Mn, V, Cr, Co, Fe, La, Sb, Br, Cl, Au, K, Sm, Sc, Na, Th, and Ti. (EPA) W73-11067

EFFECTS OF CHEMICAL VARIATIONS IN AQUATIC ENVIRONMENTS: VOLUME III: LEAD TOXICITY TO RAINBOW TROUT AND TESTING APPLICATION FACTOR CONCEPT,
Colorado State Univ., Fort Collins. Dept. of
Fishery and Wildlife Biology.
For primary bibliographic entry see Field 05C.
W73-11076

WATER RESOURCES DATA FOR ALABAMA, 1970: PART 2. WATER QUALITY RECORDS.
Geological Survey, University, Ala.
For primary bibliographic entry see Field 02K.
W73-11085

SURVEY OF APPLICATION OF RADIATION TO PREPARATIVE CHEMISTRY,
National Aeronautics and Space Administration,
Cleveland, Ohio. Lewis Research Center.
For primary bibliographic entry see Field 02K.
W73-11119

X-RAY PHOTOELECTRON SPECTROSCOPY OF METALS IN AMINO ACID COMPLEXES AND PROTEINS, (RONTGEN-PHOTOLEKTRONEN-SPERKTOSKOPIE VON METALEN IN AMINOSAUREKOMPLEXEN UND PROTEINEN),

Tuebingen Univ. (West Germany). Chemisches Institut.

G. Jung, and M. Ottnad.
Zeitschrift fur Analytische Chemie, Vol 263, No 4, p 282-285, March 6, 1973. 2 tab, 21 ref.

Descriptors: *Amino acids, *Proteins, *X-ray spectroscopy, *Pollutant identification, Metals, Ions, Copper, Cobalt, Sulfur compounds, Chemical analysis, Chemical reactions.

Identifiers: *X-ray photoelectron spectroscopy, *Metal complexes, Organometallics, Photoelectron spectra.

X-ray photoelectron spectroscopy gives information about the oxidation states and the ligands of metal ions in metalloproteins. To interpret the spectra of the metalloenzymes the photoelectron spectra of amino acid complexes were recorded. Drastic differences were noted for the binding energies of Cu and Co in the complexes and in the proteins. This is probably due to metal-metal interactions in the investigated erythrocyrupsins. Sulphur-containing compounds are very suitable for X-ray photoelectron spectroscopic measurements. It could be shown that sulphur is not involved in the binding of the metal ions. (Holoman-Battelle)
W73-11121

ANION EXCHANGE SEPARATIONS OF THE ELEMENTS EXTRACTABLE WITH TRIBUTYL PHOSPHATE,
IV. ANIONENAUSTAUSCHTRENUNGEN DER MIT TRIBUTYLPHOSPHAT EXTRAHIERBAREN ELEMENTE. IV,
Vienna Univ. (Austria). Analytisches Institut.
W. Koch, and J. Korkisch.
Mikrochimica Acta, Vol 2, p 225-244, March 1973. 5 fig, 3 tab, 1 ref.

Descriptors: *Separation techniques, *Solvent extractions, *Anion exchange, Methodology, Spectrophotometry, Chemical analysis, Lead, Manganese, Molybdenum, Adsorption, Cations, Pollutant identification, Heavy metals.
Identifiers: *Ion exchange resins, Dowex 1 X8, Tributyl phosphate, Mixtures, *Organic acids, Iodium, Thallium, Thorium, Zirconium, Arsenic, Tin, Vanadium, Antimony, Bismuth, Uranium, Selenium, Tellurium, Rare earth elements.

Methods are described for the separation of elements that can be extracted with TBP with the employment of the strongly basic anion exchanger Dowex 1 X8 in its chloride form and an aqueous-organic mixture of 30 vol. percent TBP, 60 vol. percent methylglycol, and 10 vol. percent of 12 M hydrochloric acid. In particular, separations of uranium were studied from elements that are extracted well by TBP from hydrochloric acid solutions and from those that are only poorly extracted by TBP. The differing adsorption behaviors may be explained through the resulting KIALE-effect. The behavior of the elements in the mixture containing TBP was compared with that in pure aqueous-hydrochloric acid mixtures and the difference was explained through the above effect. Separation-procedures are given for uranium from In (III), Ti (III), Tb (IV), Pb (II), Mn (II), Zr (IV), As (III, V), Sn (II, IV), Mo (VI), V (IV, V) and Sb (V). In the separation from bismuth it was possible to establish the existence of a competition of the two differing strongly adsorbed elements for the functional groups of the resin, which leads to the fact that only a part of the uranium is adsorbed. Similarly there was found a reciprocal action between uranium and manganese, whose consequence was that the manganese is preferentially eluted. In addition, a procedure is described for the separation of the elements selenium and tellurium and also for various spectrophotometric methods for the quantitative determination of the studied metal ions in mixtures containing TBP. (Holoman-Battelle)
W73-11122

DETERMINATION OF MERCURY CONTENTS IN DIVERSE SAMPLES OF FISH AND OTHER BIOLOGICAL MATERIALS BY NEUTRON ACTIVATION ANALYSIS, (NEUTRONENAKTIVIERUNGSSANALYTISCHE BESTIMMUNG VON QUERKSILBERGEHALTEN IN DIVERSEN FISCHPROBEN UND A NDEREN BIOLOGISCHEMEN MATERIALIEN),
Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Radiochemie.

H. Ruf, and H. Rohde.
Zeitschrift fur Analytische Chemie, Vol 263, No 2, p 116-120, January 26, 1973. 4 fig, 5 tab, 7 ref.

Descriptors: *Mercury, *Fish, *Neutron activation analysis, *Foods, Separation techniques.
Identifiers: *Biological samples, *Sample preparation, Tuna, Whitefish.

Mercy contents in diverse samples of fish and other biological materials have been determined by neutron activation analysis measuring the activity of Hg-197. A method described in the literature was used for the indispensable separation of the mercury activity utilizing the volatility of HgCl₂ and the low electric potential of deposition of mercury metal. The separation of Au-198 usually found in the irradiated materials was accomplished by volatilisation of the mercury metal at 850 C. Seriously high contents of mercury were found in some samples of Japanese canned tuna and in whitefish of the Rhine River. (Little-Battelle)
W73-11123

CLEAN-UP OF CRUDE EXTRACTS CONTAINING PESTICIDE RESIDUES BY AN ATOMATIC APPARATUS BASING UPON THE PRINCIPLE OF "SWEEP CO-DISTILLATION, (REINIGUNG PESTICIDDRUCKSTANDE ENTHALTENDER ROHEXTRAKTE MIT EINER AUTOMATISCH ARBEITENDEN APPARATUR NACH DEM PRINZIP DER KOMBINIERTEN SPULUND CODESTILLATION (SWEEP CODISTILLATION),
Biological Federation for Soil and Forestry, Berlin (West Germany).
J. Pflugmacher, and W. Ebinger.
Zeitschrift fur Analytische Chemie, Vol 263, No 2, p 120-127, January 26, 1973. 2 fig, 1 tab, 20 ref.

Descriptors: *Pesticide residues, *Automatic control, *Laboratory equipment, Research equipment, *Gas chromatography, Instrumentation, *Insecticides, *Organophosphorus pesticides, Methodology, Chemical analysis, Automation, Phosphothioate pesticides, Diazinon.
Identifiers: Sweep co-distillation, Cleanup, Chemical recovery, Ethyl azinphos, Bromophos, Ethyl bromophos, Chlordanephos, Chlorthion, Demeton-S, Disulfoton, Dichlorfenthion, Dichlorvos, Dimethoate, Disulfoton, Disulfoton-sulfon, Ethion, Fenchlorphos, Fenitrothion, Fenvalerathion, Fenthion, Malathion, Mevinphos, Parathion, Methyl parathion, Paraoxon, Phenkapton, Phorate, Thiometon, Thionazin.

An automatic apparatus has been constructed which cleans up crude extracts based upon the principle of 'sweep co-distillation' for gas-chromatographic residue analysis of insecticides. With this instrumentation, e.g. crude extracts from 13 crops containing 27 phosphorus pesticides have been cleaned up using unique conditions. Average recovery values reach from 66.4 to 112.4 percent. Concentration levels of the residues had been elected in accordance with the German tolerance list. The apparatus is suitable for further applications. (Holoman-Battelle)
W73-11124

APPLICATION OF RADIOCHEMICAL METHODS IN ENVIRONMENTAL RESEARCH, (ANWENDUNG RADIOCHEMISCHER METHODEN IN DER UMWELTFORSCHUNG),
Technische Hochschule, Darmstadt (West Germany). Eduard-Zintl-Institut.
K. H. Lieser.
Zeitschrift fur Analytische Chemie, Vol 263, No 4, p 304-307, March 6, 1973. 3 tab.

Descriptors: *Radiochemical analysis, *Methodology, *Indicators, *Chemical analysis, Carbon radioisotopes, Radioactivity, Heavy metals, Alkali metals, Alkaline earth metals, Halogens, Gold, Manganese, Sodium, Bromine, Chlorine, Phosphorus, Chlorine, Potassium, Chromium, Copper, Zinc, Cadmium, Mercury, Nickel, Strontium, Molybdenum, Tin, Sulfur, Calcium, Iron.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

Identifiers: Environmental research, "Dilution analysis, Sensitivity, Environmental samples, C-14, Rare earth elements, Indium, Europium, Dysprosium, Silver, Samarium, Holmium, Rhenium, Iridium, Gallium, Arsenic, Palladium, Antimony, Scandium, Lanthanum, Praseodymium, Thulium, Ytterbium, Tungsten, Osmium, Germanium, Selenium, Rubidium, Yttrium, Ruthenium, Barium, Neodymium, Gadolinium, Activation analysis, Dilution analysis, Tellurium, Terbium, Erbium, Cerium, Tantalum, Platinum, Hafnium, Thallium, Bismuth, Zirconium.

Activation analysis, dilution analysis and indicator methods (C-14, T) are discussed in general. The high sensitivity of radiochemical methods is emphasized. (Holoman-Battelle)

W73-11125

APPLICATION OF THE FLUORESCENT AN-TIBODY TECHNIQUE TO THE DIFFERENTIATION OF ASPERGILLUS SPECIES, CANDIDA SPECIES AND ZYGOGYCETES IN PARAFFIN SECTION OF FORMALIN-FIXED TISSUES, North Carolina Univ., Chapel Hill.

E. R. Williams.

Available from Univ., Microfilms, 300 No Zeeb Rd., Ann Arbor, Michigan 48106 Order No 73-4899. Ph D Dissertation, 1972. 129 p.

Descriptors: *Pathogenic fungi, *Pollutant identification, *Human diseases, Methodology, Reliability, Fluorescence, Animal diseases.

Identifiers: *Fluorescent antibody techniques, Reagents, *Candida spp., *Aspergillus spp., Zygomycetes, Antisera, Animal tissues, Staining, Candidiasis, Aspergillosis, Histology, Sample preparation, Serotypes, Rhizopus species, Absidia corymbifera, Mucor pusillus, Light microscopy, Sensitivity, Chemical digestion, Sample preservation.

It is possible to differentiate the Candida spp., Aspergillus spp., and zygomycetes in paraffin sections of formalin-fixed tissues through the use of fluorescent antibody (FA) procedures with 2 diagnostic reagents. Hyperimmune antisera were produced against C. albicans serotype A, C. albicans serotype B, C. krusei, C. parapsilosis, C. tropicalis, C. pseudotropicalis, A. flavus group (A. oryzae), A. fumigatus, Rhizopus arrhizus, R. oryzae, Absidia corymbifera, and Mucor pusillus. Antisera demonstrating indirect fluorescent antibody (IFA) titers of 1:8 or higher and their corresponding preimmunization sera were labeled with fluorescein isothiocyanate. Subsequent testing of the labeled antiglobulins and their corresponding preimmunization globulins on cultures of homologous and heterologous fungi demonstrated that 8 of the 13 reagents prepared were unsuitable for further evaluation. A mixed screening reagent for the diagnosis of candidiasis and aspergillosis was prepared by using a mixture of labeled A. fumigatus and C. pseudotropicalis adsorbed with R. arrhizus and A. ramosa. A second reagent for the identification of candidiasis was prepared by mixing labeled C. albicans serotype A and C. krusei. A third confirmatory reagent for the identification of zygomycosis was prepared against R. arrhizus antiglobulins. This latter reagent will identify all of the medically important zygomycetes with the exception of M. pusillus. An extended list of medically important fungi, those other than the Candida spp., Aspergillus spp. and the zygomycetes, was used to test these 3 diagnostic reagents for cross-reactivity. Evaluations of the mixed Candida reagent, the mixed Aspergillus reagent, and the zygomycete reagent in tissue sections showed good sensitivity and specificity for their respective diseases. Blind studies using tissue sections showed that these reagents provided a rapid, reliable and reproducible procedure for the detection and identification of these fungi in tissue. Trypsin digestion of tissue sections prior to FA staining was evaluated and found to enhance greatly the staining results in most of the tissues tested. In no case did digestion reduce

fluorescence, or affect sensitivity or specificity. The feasibility of counterstaining by FA fungi in tissue sections previously stained with conventional histological stains was evaluated. (Holoman-Battelle)

W73-11126

VOLUMETRIC DETERMINATION OF NICKEL BY HIGH FREQUENCY IMPEDIMETRY, Consejo Superior de Investigaciones Científicas, Santiago (Spain). Departamento de Química Analítica.

S. Bars-Temes, F. Bermejo-Martinez, and A.

Prieto-Bouza.

Microchemical Journal, Vol 17, No 6, p 625-631, December 1972. 3 tab, 2 ref.

Descriptors: *Nickel, *Volumetric analysis, *Aqueous solutions, Chemical analysis, Heavy metals, Methodology, Separation techniques, Iron, Aluminum.

Identifiers: *High frequency impedimetry, Chemical interference, Accuracy, Alkaline media, Sodium bicarbonate.

A method is proposed for the determination of nickel by high frequency impedimetry in the presence of aluminum, iron, calcium, and mercury by the use of TTHA in NaHCO₃ medium. A sample volume containing not more than 6 mg of nickel is placed in the titration cell to which is added 1 ml of one percent sodium bicarbonate solution. The mixture is then removed for 2 min to allow precipitation and then diluted with deionized water to 80 ml. Titration is carried out with 0.01 M disodium salt of TTHA solution. The method is accurate in the presence of not more than 0.0004 mole of noninterfering substances. (Holoman-Battelle)

W73-11127

ALPHA-AL203 AS AN ADSORBENT IN THIN-LAYER CHROMATOGRAPHY, Silesian Univ., Katowice (Poland). Inst. of Chemistry.

B. Korczak, J. Wegrzynek, H. Habla, and J.

Siwiok.

Microchemical Journal, Vol 17, No 6, p 632-637, December 1972. 5 fig, 2 tab, 4 ref.

Descriptors: *Separation techniques, Methodology, *Organic compounds, Pollutant identification, Chemical analysis.

Identifiers: *Adsorbents, *Thin layer chromatography, Alpha-Aluminum oxide, Alumina, Butter yellow, Sudan G, Indophenol, Organic dyes.

The utility of laboratory-made alpha-Al203 as an adsorbent in the thin layer chromatographic separation of selected organic compounds was determined by the separation of a mixture of test dyes (butter yellow, Sudan G and indophenol) and calculation of the following coefficients: R sub f, Lpt, I sub g and t. The comparison was made conducting the same experiments with Al203 produced by Woelcm. Aluminum oxide was prepared by sieving aluminum hydroxide (USSR) to unify granule diameter and roasting at 1250°C for 5 hr. It was shown to have several advantages common to proper adsorbents for TLC purposes. (Holoman-Battelle)

W73-11128

STUDY OF THE CHANGES IN THE STRUCTURE OF TWO ALgal POPULATIONS: AN R-TYPE FACTOR ANALYSIS, Louvain Univ. (Belgium). Institut Carnoy.

F. Symons.

Hydrobiologia, Vol 41, No 1, p 107-112, Feb 28, 1973. 3 tab, 4 ref.

Descriptors: *Diatoms, *Chlorophyta, *Plant populations, *Biological communities, Statistical methods, Ponds, Correlation analysis, Scenedesmus, Chrysophyta.

Identifiers: *Species diversity, Synedra species, Navicula species, Amphora ovalis var. pediculus, Cymbella affinis, Nitzschia species, Surirella robusta var. splendida, Pediastrum species, Scenedesmus species.

Two algal populations of the same pond were studied over a period of 8 months. For each of those populations an r-type factor analysis has been executed. Three independent species structures were proposed for each of the populations. Characteristic differences between the two populations are discussed under the assumption that one of them should be more self-regulating than the other one. A possible interaction between the development of diatoms and green algae is put forward as a perspective for further research. (Little-Battelle)

W73-11129

PARTITIONING OF A BRACKISH WATER HABITAT BY COPEPOD SPECIES, Ghent (Belgium). Dept. of Zoology Rijksuniversiteit.

C. Heip.

Hydrobiologia, Vol 41, No 2, p 189-198, March 29, 1973. 1 fig, 5 tab, 8 ref.

Descriptors: *Dominant organisms, *Brackish water, *Copepods, *Succession, *Niches, Benthos, Sediments, Sampling, Reproduction, Periphyton, Zooplankton, Distribution patterns, Biological communities, Balance of nature.

Identifiers: *Sample preparation, Macroinvertebrates, *Belgium (Dievenig), Halicyclops magniceps, Diacyclops bisetosus, Megacyclops viridis, Canuella perplexa, Tachidius discipes, Amphiscoidea debilis, Schizophera compacta, Nitocra typica, Nitocra spinipes, Mesochra lilljeborgi, and Paronychocampus nanus. The successful species show a separation in time with regard to the date of maximum occurrence and the date of maximum reproductive activity. The succession of the five species examined is: Mesochra lilljeborgi, Paronychocampus nanus, Tachidius discipes, Halicyclops magniceps and Canuella perplexa. Moreover, these species and others show a separation in space: C. perplexa is an endopasmic, Paronychocampus nanus a mesopasmic, and Tachidius discipes an epipsammic species. Three cyclopoid species are planktonic. Two other species (Nitocra typica and Mesochra lilljeborgi) are more numerous in the periphyton than in the benthos. (Little-Battelle)

ENUMERATION AND DIFFERENTIATION OF WATER BACTERIA WITH PHOSPHORUS-32, Roorkee Univ. (India).

P. Khanna.

Journal Water Pollution Control Federation, Vol 45, No 2, p 262-268, February 1973. 4 fig, 4 tab, 11 ref.

Descriptors: *E. coli, *Radioactivity techniques, Absorption, *Phosphorus, Pollutant identification, Separation techniques, Coliforms, Enteric bacteria, Streptococcus, Water analysis.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

Identifiers: Co-precipitation, **Streptococcus faecalis*, **Aerobacter aerogenes*, **Proteus vulgaris*, P-32.

A co-precipitation method for enumerating bacteria in water samples is based on the fact that non-multiplying cells utilize phosphorus by rapidly turning over ribonucleic acid and phosphoproteins. Since these compounds are insoluble in cold trichloroacetic acid (TCA), they can be precipitated out and measured so that the incorporation of radioactive phosphorus can be followed. The method was tested by mixing buffered E. coli, P-32, and carrier phosphorus and incubating for various time periods. After incubation, a clear solution of eggwhite equilibrated with carrier phosphorus was added, the mixture stirred, and cold TCA added to cause precipitation. The precipitate was then centrifuged, washed in TCA, ethanol, ethanol-ether, and ether, suspended in acetone, and filtered through a Whatman No. 4 disk. The P-32 activity was read from the filters with a Geiger-Mueller counter as an estimate of the bacterial population. The method, which provided results in 4 hrs., showed a linear relationship between population and phosphorus uptake in exposures up to 14 hrs. Tests with E. coli, *Streptococcus faecalis*, *Aerobacter aerogenes*, and *Proteus vulgaris* showed that gram-positive and negative cells can be differentiated by appending 1 percent KOH and 2 percent bile salt, respectively, to test samples. (Holoman-Battelle) W73-11133

ISOLATION OF SALMONELLA FROM MODERATELY POLLUTED WATERS,

Department of the Environment, Burlington (Ontario). Centre for Inland Waters.

B. J. Dutka, and J. B. Bell.

Journal Water Pollution Control Federation, Vol 45, No 2, p 316-324, February 1973. 2 fig, 4 tab, 23 ref.

Descriptors: *Water sampling, *Isolation, *Water pollution, *Salmonella, Methodology, *Pollutant identification, On-site tests, Laboratory tests, On-site investigations, Enteric bacteria, Coliforms, Pathogenic bacteria, Filtration, St. Lawrence River, Aerobic bacteria.

Identifiers: *Selective media, Culture media, Enrichment, Culturing techniques, Biochemical tests, Serotypes, Fecal coliforms, Fecal pollution, Fecal streptococci, Plate counts, Membrane filters, Species density, Tetraphionate broth, Selenite broth, Brilliant green agar, Antisera, Bay of Quinte, Most probable number test, Salmonella species.

Qualitative sampling techniques and enrichment broth/selective agar combinations for the demonstration of *Salmonella* in receiving waters were compared. The sampling procedures used were: (1) placement of collecting pad (s) at a specific station; (2) collection of a 5-gal (18.9-l) grab sample; (3) field filtration of 50 gal (189 l) of water in 5-gal (18.9-l) units; (4) collection of approximately 400 ml of water for coliform, fecal coliform, and fecal streptococcus density determinations and for 20 and 35 C standard plate count tests. One to eight days later the collecting pads were retrieved, and Procedures 2, 3, and 4 were repeated. All water samples, collecting pads, and filters were put on test within 6 hr of collection. Strips of the collecting pad (s), and the various filters were aseptically placed in both prewarmed tetraphionate and selenite enrichment broths. After incubation at 41.5 C for 20 plus or minus 2 hr, colonies resembling salmonellae were screened using phenylalanine and Mac Conkey's agars and incubated overnight at 35 C. Cultures showing reactions typical of *Salmonella* with these media were slide tested with *Salmonella* polyvalent O antisera. Specific O and H antisera were used to identify fully all suspected salmonellae. The collecting pad and 50-gal (189-l) field-filtered samples were equally efficient in isolating *Salmonella* from waters containing low to moderate numbers of

coliforms. The efficiency of the collecting pads did not increase with prolonged exposure (3 to 5 days). The use of the 50-gal (189-l) on-site filtering technique is recommended for routine stream surveys. Tetraphionate broth/brilliant green agar proved to be the most productive broth agar combination, but in different geographical locations, other media combinations may prove to be more productive. (Holoman-Battelle) W73-11134

OCCURRENCE OF SALMONELLA IN OXIDATION DITCHES,

Rijksinstituut voor de Volksgezondheid, Bilthoven (Netherlands). Lab. for Zoonoses. E. H. Kampelmacher, and L. M. van Noort Jansen.

Journal Water Pollution Control Federation, Vol 45, No 2, p 348-352, February 1973. 5 tab, 4 ref.

Descriptors: *Oxidation lagoons, **Salmonella*, *Pollutant identification, *Waste water (Pollution), *Waste water treatment, Effluents, Sampling, Efficiencies, Industrial wastes, Methodology, Aerobic bacteria, Enteric bacteria, Isolation, Diseases.

Identifiers: *Slaughterhouse wastes, Tetraphionate broth, Enrichment, Most probable number test, Influent, *Salmonella* infantis, *Salmonella* bimini, *Salmonella* typhimurium var. copenhagen, *Salmonella* tennessee, *Salmonella* derby, *Salmonella* bredeney, *Salmonella* brandenburg, *Salmonella* give, *Salmonella* livingstone, *Salmonella* panama, *Salmonella* typhimurium, *Salmonella* manchester, *Salmonella* stanley, *Salmonella* thompson.

An investigation was undertaken to determine the capability of oxidation ditches of the type used in small municipalities for the treatment of waste water. Two oxidation ditches that treat slaughterhouse wastes were studied in reference to their ability to remove *Salmonella*. Five 100 ml samples of circuit liquid, influent, and effluent were collected within 30 min, transferred together to a liter bottle, and thoroughly shaken. The mixed samples were tested for salmonellae within a 4-hr period using tetraphionate enrichment media prepared by the Muller-Kauffmann method, and the most probable number (MPN) computed. Variable numbers of *Salmonella* species were present in the effluent of the plants studied. The number of salmonellae/100 ml was less than 20, with one exception (350/100 ml). The ability of the plants to remove *Salmonella* was comparable to that of conventional waste water treatment plants. Exact measurements of *Salmonella* reduction in the plant effluents were not possible, but it was feasible to determine bacteria counts in the influent, circuit liquid, and effluent during specific periods. In one of the plants, *Salmonella* contamination could be traced to its source. Results support a theory about the circulation of *Salmonella* bacteria in natural systems. (Holoman-Battelle) W73-11136

REMOTE SENSING TECHNIQUES FOR DETECTING OIL SLICKS,

National Aeronautics and Space Administration, Washington, D.C.

C. E. Catoo. Journal of Petroleum Technology, Vol 25, p 267-278, March 1973. 12 fig, 2 tab, 13 ref.

Descriptors: *Oil spills, *Remote sensing, *Pollutant identification, *Optical properties, *Fluorescence, *Reflectance, Methodology, Physical properties, Water pollution, Sea water, Radar, Infrared radiation, Oil pollution, Mapping, Ultraviolet radiation.

Identifiers: Oil films, Oil types, Panchromatic photography, Infrared photography, Multispectral photography, Ultraviolet imagery, Color photography, Infrared color photography, Infrared imagery, Passive microwave imagery, Infrared radiometry, Infrared spectral radiometry, Passive

radiometry, Fraunhofer line discriminator, Barringer correlation spectrometer, Wide-range image, Spectrophotometer, Multispectral optical-mechanical scanner imagery.

Those signature properties of oil slicks that make them amenable to remote sensing are described with emphasis on those signature properties that are useful in (1) detecting oil films on water surfaces, (2) mapping the areal extent of the slicks, (3) measuring the thickness of the slicks, and (4) identifying oil types. The reflective and fluorescent signatures are correlated with detection in the ultraviolet, visible, infrared, microwave, and radar regions. Remote sensing techniques are considered in two broad categories: imaging techniques (spatial dimension), and nonimaging techniques (spectral dimension). The imaging techniques are panchromatic photography, infrared photography, multispectral photography, ultraviolet imagery, infrared imagery as well as multispectral, optical-mechanical scanner imagery, color photography, infrared color photography, radar, and passive microwave imagery. Nonimaging techniques include infrared radiometry, infrared spectral radiometry, passive radiometry, Fraunhofer line discriminator, Barringer, correlation spectrometer, and wide-range image spectrophotometer. (Holoman-Battelle) W73-11137

A CONTINUOUS-FLOW APPARATUS FOR ASSESSING THE TOXICITY OF SUBSTANCES TO MARINE ANIMALS,

Ministry of Agriculture, Fisheries and Food, (England). Fisheries Lab.

For primary bibliographic entry see Field 05C.

W73-11169

FALLOUT OF SODIUM SULPHATE NEAR A KRAFT MILL,

Lakehead Univ., Thunder Bay (Ontario). Dept. of Physics.

L. Hastings, R. Freitag, and A. Smith. Atm Environ. Vol 6, No 4, p 241-246, 1972. Illus.

Identifiers: *Fallout (Kraft Mill), Snow, *Sodium sulfate, *Air pollution.

The rate of fallout of SO₄²⁻ in the form of Na₂SO₄ in the vicinity of a kraft mill was determined by taking samples of accumulated snow. The distribution of fallout as a function of distance from the mill was determined.—Copyright 1972, Biological Abstracts, Inc.

W73-11175

PRECISION AND DETECTION LIMITS OF CADMIUM, MANGANESE, COBALT, AND NICKEL IN SULFIDES BY ELECTRON MICROPROBE ANALYSIS,

Geological Survey, Denver, Colo.

R. H. Heidel.

Analytical Chemistry, Vol 44, No 11, p 1860-1862, September 1972. 3 tab, 8 ref.

Descriptors: *Analytical techniques, *Instrumentation, *Evaluation, *Metals, Chemistry, Chemical properties, Mineralogy, Laboratory tests, Electrochemistry, Measurement, Cobalt, Nickel, Cadmium, Manganese, Sulfides, Silicates.

Identifiers: *Electron microprobe analysis.

The electron microprobe is discussed as a means of analyzing very small amounts of metal and of finding the levels of concentration of metals in sulfides. It offers the unique advantage of analyzing mixtures of minerals rapidly and accurately where conventional chemical methods are not possible or feasible. Although the detectability limits for the electron microprobe are poor when considered in terms of the minimum amount of an element detected relative to the total sample in a homogeneous mixture, the ultimate sensitivity is very high considering the number of atoms required to

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

produce a signal detectable above the background. Sensitivities, precision and minimum detectability limits were obtained and presented for cobalt, nickel, manganese, and cadmium. The limits are basically higher in sulfides than for these elements in silicates. Improvement in counting precision and correspondingly better analytical results are possible with longer counting periods. (Jerome - Vanderbilt) W73-11178

APPLICATION OF REGRESSION ANALYSIS TO THE STUDY OF BACKGROUND VARIATIONS IN TRACE METAL CONTENT OF STREAM SEDIMENTS,
British Columbia Univ., Vancouver. Dept. of Geology.
J. Chatupa, and K. Fletcher.
Economic Geology, Vol 67, No 7, p 978-980, November 1972. 4 ref.

Descriptors: *Metals, *Streambeds, *On-site investigations, *Regression analysis, Streams, Sediments, Trace elements, Copper, Zinc, Iron, Manganese, Nickel, Sampling, Mathematical studies. Identifier: *Background level.

Forty stream sediment samples were analyzed for copper, zinc, iron, manganese and nickel. The results demonstrate the extent to which background fluctuations in trace element content of sediments can be accounted for by a few readily determined parameters such as iron content, <270 mesh material, ignition loss, and stream sample pH. Having established the regression equation for a trace element, a theoretical value for its content in a particular sample and the difference, or residual, between this value and the reported content can be found. Large positive residuals indicate additional sources of metal unaccounted for by the independent variables. (Oleszkiewicz - Vanderbilt) W73-11179

COMPOSITION OF AIRBORNE LEAD PARTICLES,
Ethyl Corp. Research Labs., Ferndale, Mich.
G. L. Ter Haar, and M. A. Bayard.
Nature, Vol 232, No 5312, p 553-554, August 20, 1971. 5 ref.

Descriptors: *Air pollution, *Heavy metals, *Lead, *Public health, Chemistry, Pollutant identification, Effluents, Halogens, Gasoline, X-ray diffraction. Identifier: Lead compounds.

Air samples were collected from a rural area, a busy highway, and about 400 yards from that highway in an investigation of airborne lead particles and the role of automobile exhaust in their formation. The air samples were analyzed for 14 different lead compounds. The samples taken near the highway and 400 yards from the highway contained about 2.6% and 1.2% lead respectively, while the rural sample contained only a few tenths of a percent lead. Samples of automobile exhaust were also taken and passed into a 4,000 cubic foot black plastic bag containing clean dry air. The air bag data showed that lead bromide and chlorine compounds will break down and form lead carbonates, oxycarbonate and oxides within 18 hours without sunlight. These results make it unnecessary to postulate photolysis of lead compounds to account for loss of halogen. It is suggested that lead oxide, lead carbonate, basic lead carbonate or a mixture of these would be a good choice for experimental studies of the health effects of lead in the atmosphere. (Jerome - Vanderbilt) W73-11188

WATER SAMPLING GUIDELINES AND INTERPRETATION OF DATA,
Environmental Health Lab., McClellan AFB, Calif.

For primary bibliographic entry see Field 07A.
W73-11205

LIQUID SAMPLING,
Pro-Tech, Inc., Malvern, Pa. (assignee).
For primary bibliographic entry see Field 07B.
W73-11235

WASTE WATER SAMPLER,
Tri-Aid Sciences, Inc., Rochester, N.Y. (assignee).
L. G. Lynn, and D. A. Quadrini.
U. S. Patent No 3,719,081, 7 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 908, No 1, p 45, March 6, 1973.

Descriptors: *Patents, *Waste water, *Sampling, Equipment, *Pollution abatement, *Water pollution control, *Water quality control.

This apparatus is intended for automatically and periodically collecting samples from a stream of waste water for pollution control purposes. At a control point a signal is applied to an integrator which produces an output voltage proportionate to the quantity of effluent that has passed the probe in a preceding interval. Each time the voltage reaches a predetermined value, a threshold circuit resets the integrator and pulses a first register to record the quantity of effluent for a given period, and simultaneously pulses a presettable counter. This produces a sampler enabling signal every time the counter reaches zero and resets. This enabling signal momentarily energizes a solenoid in a remote sampler to cause it to pump a sample of waste water from the flume to a sample receptacle. (Sinha-OEIS) W73-11243

AREAWIDE TRACE METAL CONCENTRATIONS MEASURED BY MULTIELEMENT NEUTRON ACTIVATION ANALYSIS - A ONE DAY STUDY IN NORTHWEST INDIANA,
Michigan State Univ., East Lansing. Dept. of Meteorology and Oceanography.
For primary bibliographic entry see Field 05B.
W73-11278

ARSENIC, CADMIUM, COPPER, MERCURY, AND ZINC IN SOME SPECIES OF NORTH ATLANTIC FINFISH,
Skidaway Inst. of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 05B.
W73-11279

HEAVY METALS: FALLOUT AROUND A POWER PLANT,
Hope Coll., Holland, Mich. Dept. of Chemistry.
D. H. Klein, and P. Russell.
Environmental Science and Technology, Vol 7, No 4, p 357-358, April 1973. 2 fig, 1 tab, 3 ref.

Descriptors: *Soil pollution, *Heavy metals, *Fallout, *Coals, *Sampling, Testing, Electric power production, *Air pollution, Lead, Cadmium, Cobalt, Chromium, Copper, Iron, Mercury, Nitrogen, Titanium, Zinc, Atmosphere, Fossil fuels, Analytical techniques, Measurements.

Research is reported on the problem of land area which would be burdened by fallout from a major coal burning facility. The area surrounding a 650 Mw electric generating plant on the eastern shore of Lake Michigan was chosen for the study. Samples of soil and Lake Michigan sediments were taken from 45 sites and were analyzed for metal content. Soils around the plant were found to be enriched in Ag, Cd, Co, Cr, Cu, Fe, Hg, Ni, Ti, and Zn. This enrichment corresponded to wind patterns and with the metal content of the coal except for Hg, which was only slightly enriched. Plant materials were enriched in Cd, Fe, Ni, and Zn. (Jerome - Vanderbilt) W73-11282

WATER ANALYSIS,
Geological Survey, Lakewood, Colo.
For primary bibliographic entry see Field 02K.
W73-11285

SEA FISH CONTAMINATION WITH MERCURY (CONTAMINATION DES POISSONS DE MER PAR LE MERCURE),
For primary bibliographic entry see Field 05C.
W73-11289

THE USE OF ATOMIC ABSORPTION FOR ANALYSIS OF NATURAL WATERS,
Geological Survey, Denver, Colo.
M. J. Fishman.
Atomic Absorption Newsletter, Vol 5, No 5, p 102-106, September-October 1966. 7 fig, 10 tab, 1 ref.

Descriptors: *Metals, *Surface waters, *Absorption, *Analytical techniques, Instrumentation, Analysis, Sodium, Zinc, Copper, Potassium, Manganese, Calcium, Strontium, Laboratory tests, Water quality, Water pollution, Indicators, Trace elements.
Identifiers: *Atomic absorption spectroscopy, Lithium, Sensitivity.

Atomic absorption methods have been applied to the determination of sodium, potassium, lithium, strontium, calcium, magnesium, copper, manganese, and zinc in natural waters. The interference effects most likely to occur from other substances normally found in water were investigated, and means of eliminating interferences are discussed. Detection limits for many of the elements are as low as or lower than those obtained by other methods. Recovery in tests, replicate analyses, and comparison of results with those obtained by other methods show that atomic absorption methods are accurate and reproducible, and provide a more rapid means for the determination of these elements in water. (Oleszkiewicz-Vanderbilt) W73-11291

DISTRIBUTION OF DISSOLVED MERCURY IN THE IRISH SEA,
Liverpool Univ. (England). Dept. of Oceanography.
For primary bibliographic entry see Field 05B.
W73-11293

ATOMIC ABSORPTION SPETROPHOTOMETRY AS A TOOL FOR THE WATER CHEMIST,
Calgon Corp., Pittsburgh, Pa.
J. A. Platte, and V. M. Marcy.
Atomic Absorption Newsletter, Vol 4, No 6, p 289-292, June 1965. 3 fig, 5 tab, 4 ref.

Descriptors: *Instrumentation, *Water analysis, *Metals, Analytical techniques, Iron, Copper, Magnesium, Calcium, Zinc, Nickel, Separation techniques, Laboratory tests, Absorption, Water quality, Trace elements, Chemical analysis.
Identifiers: *Atomic absorption spectroscopy, *Sensitivity, *Accuracy.

Water analyses by atomic absorption are compared to those by classical methods for the determination of iron, copper, zinc, manganese, calcium, and magnesium. Water-formed deposits are analyzed for iron, copper, magnesium, calcium, zinc, and nickel and the results are compared to those by gravimetric analyses. Silicon interference with iron and manganese determinations is eliminated by the addition of calcium. Potential interferences of phosphate, aluminum, and silicon with calcium and magnesium determinations are controlled by the addition of lanthanum. (Oleszkiewicz - Vanderbilt) W73-11294

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

DETERMINATION OF TOTAL CHROMIUM IN FRESH WATERS BY ATOMIC ABSORPTION, Geological Survey, Denver, Colo.

M. R. Midgett, and M. J. Fishman.

Atomic Absorption Newsletter, Vol 6, No 6, p 128-131, November-December 1967. 1 fig, 7 tab, 3 ref.

Descriptors: *Chromium, *Spectrophotometry, Freshwater, *Analytical techniques, Sampling, Separation techniques, Instrumentation, Oxidation, Trace elements, Water quality, Chelation, Indicators.

Identifiers: *Atomic absorption spectroscopy.

A rapid and sensitive atomic absorption method for the determination of chromium in fresh waters is described. Chromium is first oxidized to the hexavalent state with potassium permanganate and the excess permanganate reduced with sodium azide. The pH is then adjusted to 2.4 with hydrochloric acid, using bromophenol blue indicator, and chromium chelated with ammonium pyrrolidine dithiocarbamate. The metal chelate is extracted with methyl isobutyl ketone and the ketone layer containing the chromium chelate is then aspirated. As little as 1 microgram/l of chromium can be detected. (Oleszkiewicz - Vanderbilt) W73-11297

THE DETERMINATION OF SMALL AMOUNTS OF MERCURY IN ORGANIC MATTER.

Analyst, Vol 90, No 1074, p 515-530, September 1965. 1 fig, 20 tab, 7 ref.

Descriptors: *Analytical techniques, *Spectrophotometry, *Mercury, *Organic matter, *Solvent extractions, Colorimetry, Metals, Separation techniques, Acids, Digestion, Distillation, Laboratory tests, Testing procedures, Measurements, Evaluation.

Identifiers: Dithizone.

Investigations were performed to find the most reliable and effective method to determine trace amounts of mercury in organic matter. In tests of the wet digestion method of sample preparation, organic samples containing Hg-203 labelled mercury lost appreciable amounts of Hg by volatilization. These losses may be overcome if the volatilized Hg is trapped and combined with digestate before determination. The addition of nitric acid would maintain oxidizing conditions during decomposition and reduce losses of Hg through distillation. Dithizone should be used for the extraction of mercury from the wet digestate. The method of mixed-color titration, the spectrophotometric method using dithizone to extract mercury and a similar method using a toluene solution of dithizone to extract mercury were tested as means of determining mercury concentrations. The findings of these tests are combined in a method of mercury extraction and determination which has a lower limit of approximately 0.5 micrograms (0.05 ppm). (Jerome - Vanderbilt) W73-11296

DETERMINATION OF TRACE MERCURY IN SOIL AND ROCK MEDIA, Colorado School of Mines, Golden. Dept. of Chemistry.

R. Z. Pyrh, and R. E. Bisque.

Economic Geology, Vol 64, p 825-828, 1969. 1 fig, 1 tab, 6 ref. US-GS Grant 14-08-001-G-12.

Descriptors: *Mercury, *Soils, *Rocks, *Geochemistry, Geologic investigations, Absorption, Instrumentation, Separation techniques, Analysis, Geological surveys, Spectrophotometry. Identifiers: *Atomic absorption spectroscopy, Sensitivity, Accuracy.

The technique of mercury determination described requires an atomic absorption spectrophotometer and a relatively simple chemical procedure to ob-

tain sensitive and accurate results for trace amounts of mercury. The lower limit of detection with this technique is 0.05 micrograms of mercury. Using a one gram sample, 50 parts per billion of mercury can be detected; increasing sample size will lower the detection limit to a few parts per billion, well below the average abundance of mercury in crustal rock, 0.08 parts per million. With access to an atomic absorption spectrophotometer, the proposed method is simple, convenient, inexpensive, and rapid. With adequate laboratory facilities and equipment, two men can digest and analyze 200-300 prepared samples per day. (Oleszkiewicz - Vanderbilt)

W73-11297

ATOMIC ABSORPTION SPECTROPHOTOMETRY IN THE FIELD OF MARINE RESEARCH, Alaska Univ., College. Inst. of Marine Science. D. C. Burrell.

Atomic Absorption Newsletter, Vol 7, No 4, p 65-68, July-August 1968. 2 tab, 36 ref.

Descriptors: *Instrumentation, *Metals, *Water analysis, *Sea water, Oceanography, Geochemistry, Copper, Iron, Manganese, Zinc, Nickel, Cobalt, Strontium, Heavy metals, Trace elements, Analytical techniques, Laboratory tests, Water pollution.

Identifiers: *Atomic absorption spectroscopy, *Detection limit, Sensitivity, Accuracy, Marine chemistry.

Various applications of atomic absorption spectrophotometric analysis in the oceanographic sciences are reviewed, with examples predominantly in the field of marine chemistry and geochemistry. Particular emphasis is given to the instrumentation and techniques required for the determination of trace transition metals in marine waters and sediments. Detection limits for such metals as copper, iron, manganese and zinc are 0.1, 0.2, 0.07, and 0.1 mg/l respectively. (Oleszkiewicz - Vanderbilt) W73-11306

TRACE ELEMENTS IN THE ATMOSPHERIC ENVIRONMENT, Atomic Energy Research Establishment, Harwell (England).

D. H. Peirson, P. A. Cawse, L. Salmon, and R. S. Cambray. Nature, Vol 241, No 5387, p 252-256, January 26, 1973. 4 fig, 2 tab, 35 ref.

Descriptors: *Trace elements, *Air pollution, Lead, Zinc, Iron, Aluminum, Calcium, Sodium, Mercury, Alkali metals, Heavy metals, Path of pollutants, Pollutant identification, Distribution, Rainfall, Seasonal.

Identifiers: Particulates, Washout, Deposition.

Some 30 elements have been determined quantitatively in aerosol samples from Wraymires, either as weekly or monthly concentrations. In addition, nine other elements have been qualitatively identified. The highest concentrations have been approximately 1 microgram per kg of air, in the case of Cl, Na and Ca. Next in abundance are Al, Fe, Pb and Zn. The total mass of particulates was about 20 microgram/kg of air. Over the limited period of measurement there was a general increase in the concentrations in air during the winter compared with summer, for a number of the elements measured. This was attributed to the seasonal reduction in the vertical diffusion in the atmosphere; it is associated with the increased frequency of temperature inversions during the winter. Certain derived parameters, 'washout factor' W and 'dry deposition velocity' V sub g, are summarized together with the total deposition T and dry deposition D, all as mean monthly values during the year 1971. (Oleszkiewicz - Vanderbilt) W73-11302

AUTO EXHAUST - LEAD VS AROMATICS, Du Pont de Nemours (E. I.) and Co., Wilmington, Del.

J. M. Pierrard, and R. A. Crane.

Hydrocarbon Processing, Vol 50, No 9, p 142-146, September 1971. 4 fig, 6 tab, 17 ref.

Descriptors: *Aromatic compounds, *Lead, *Gasoline, Air pollution, *Air pollution effects, Gases, Smog, Fuels, Path of pollutants, On-site tests.

Identifiers: *Automobile exhausts, *Emissions, Vision, Tetraethyl-lead, Particles, Unleaded fuels.

Results are reported of an investigation to determine the effect of particulate emissions in vehicle exhaust on atmospheric soiling and visibility degradation. Leaded and unleaded gasolines were compared using 1969, 1970 and 1971 model automobiles. The two series of experiments described provided direct measurements of soiling and visibility degradation under realistic operating conditions. The tunnel fleet test data show that the light extinction coefficient after driving unleaded cars was approximately one and one-half times that after driving leaded cars. As visibility is inversely proportional to extinction coefficient the implication is that the contribution of automotive primary particulate matter to visibility reduction in St. Louis would increase from the present 1.5 to 2.1 percent if unleaded fuel were used. It is concluded that even this higher value caused by unleaded fuel is still a relatively insignificant contribution to air quality degradation in this instance. (Oleszkiewicz - Vanderbilt) W73-11301

LEAD EMISSIONS FROM INCINERATED SEWAGE SLUDGE DETECTED ON TREE FOLIAGE, Connecticut Agricultural Experiment Station, New Haven.

G. R. Stephens, L. Hankin, and W. D. Glover, Jr. Journal of Air Pollution Control Association, Vol 22, No 10, p 799-800, October 1972. 2 tab, 11 ref.

Descriptors: *Lead, *Incineration, *Sewage sludge, *Heavy metals, Air pollution, Plants, Respiration, Trees, Copper, Nickel, Zinc, Chromium, Cadmium, Connecticut, Analytical techniques, Analysis, Spectrophotometry, Instrumentation, Path of pollutants, Precipitation.

Identifiers: *Atomic absorption spectroscopy, Tree foliage, Sensitivity.

A localized source of lead emission, incineration of sewage sludge derived from two heavily industrialized areas, is reported. Preliminary investigation suggested that lead in sewage sludge from one treatment facility was being emitted during incineration. An attempt was made to detect lead on vegetation near the incinerator. The foliage of trees in the vicinity of two sewage sludge incinerators was examined and its lead content was compared with that of foliage near a busy highway and in an isolated rural area. Daily inputs of other heavy metals (Cd, Cr, Cu, Pb, Ni, Zn) from incinerated sewage sludges are also reported. As opposed to other metals lead can be detected easily in the tree foliage. (Oleszkiewicz - Vanderbilt) W73-11302

INCIDENCE OF MERCURY IN ILLINOIS PHEASANTS, Illinois State Natural History Survey, Urbana.

W. L. Anderson, and P. L. Stewart.

Transactions of the Illinois Academy of Science, Vol 64, No 3, p 237-241, 1971. 1 tab, 12 ref.

Descriptors: *Mercury, *Soil contamination, *Game birds, *Illinois, Biochemistry, Chemical analysis, Pollutant identification, Bioindicators, Birds, Testing, Laboratory tests, Data collection, Sampling.

Identifiers: Pheasants.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

Selected tissues from 20 pheasants collected in east-central Illinois during August 1970 were analyzed for elemental mercury by emission spectrography. Frequencies of occurrence and mean concentrations were 35 per cent and <0.06 ppm in kidneys, 40 per cent and 0.03 plus or minus 0.01 ppm in livers, 15 per cent and 0.32 plus or minus 0.30 ppm in brains, 25 per cent and 0.02 plus or minus 0.01 ppm in leg muscles, 15 per cent and 0.03 plus or minus 0.02 ppm in sternal muscles. The high mean concentration in brains was due to 5.93 ppm found in one bird. The second highest individual concentration was 0.44 ppm and occurred in kidneys. Eight soil samples, collected from the fields in which the pheasants were taken, contained a mean of 0.02 plus or minus 0.01 ppm of mercury. Thus, neither pheasants nor soils in east-central Illinois appear to be contaminated with potentially dangerous levels of mercury. (Jerome - Vanderbilt)

W73-11305

DITHIZONE PROCEDURE FOR MERCURY ANALYSIS,

Environmental Protection Agency, Grosse Ile, Mich. Lake Huron Basin Office.

C. T. Ely.

Journal of the Water Pollution Control Federation, Vol 45, No 5, p 940-945, May 1973. 3 fig, 2 tab, 4 ref.

Descriptors: *Pollutants, *Mercury, *Pollutant identification, *Analytical techniques, Water pollution, Sources of water pollution, Metals, Spectrophotometry, Chemical degradation, pH, Laboratory tests, Testing procedures, Instrumentation, Chemical analysis.

Identifiers: Dithizone.

Tests of the rapidity, sensitivity, reliability and economy of the dithizone method of mercury extraction were performed. The mercury was determined by extraction of mercuric ion with a chloroform solution of dithizone in 1N sulfuric acid solution. At a pH of 0.3 metals such as lead, cadmium, zinc, nickel, cobalt, iron and copper did not interfere. The addition of acetic acid stabilized the mercury-dithizone complex for at least 1 hour. Beer's Law was followed over a concentration range of 0.002 to 0.040 mg/l of mercury (II). In a precise study a relative standard deviation of 3.0% was obtained. Maximum absorptivity of this complex is at 500 M microns. The advantages of this procedure are low relative standard deviation and low relative error, low cost and simplicity of reagents and equipment. Disadvantages include false chlorine interference, possible copper (I) and iron (III) interference, variables affecting the sensitivity, questionable ability to measure all forms of mercury without digestion and inability to detect amounts less than 2 micrograms/l of mercury (II). (Jerome - Vanderbilt)

W73-11306

TRACE METAL CONTENT OF HAIR, I. ZINC AND COPPER CONTENT OF HUMAN HAIR IN RELATION TO AGE AND SEX,

Cincinnati Univ., Ohio. Coll. of Medicine, and Cincinnati Univ., Ohio. Dept. of Environmental Health.

H. G. Petering, D. W. Yeager, and S. O. Witherup. Archives of Environmental Health, Vol 23, No 3, p 196-201, September 1971. 3 fig, 1 tab, 17 ref.

Descriptors: *Bioassay, *Spectrophotometry, *Copper, Zinc, *Statistics, Biochemistry, Metals, Trace elements, Analytical techniques, Toxicity, Toxins, Testing procedures, Data collections, Sampling, Metabolism.

Identifiers: Human hair, Human physiology.

The zinc and copper levels in the hair of a group of 211 persons of both sexes and in an age range from 1 to 80 years were analyzed. The hair was obtained from volunteers when they had their hair cut by a

barber. The hair was washed with solvents and detergents and dried. The samples were then ashed and subjected to atomic absorption spectrophotometry. Statistical analysis plots were performed for age and sex. The average accuracy of the method exceeded 96%. Graphs show the zinc and copper concentration plots for age and sex. The content of zinc in the hair of males increased from 105 ppm at age 2 to 180 ppm at age 15 and then slowly decreased to 125 ppm at age 80. Copper concentrations started at about 13 ppm at age 2, increased to 60 ppm at age 12 and decreased to 9 or 10 ppm at age 80. The average content of zinc in the hair of females was very similar to that in males at a comparable age. Copper concentrations in female hair showed an insignificant rise with age. Suggestions are made for testing and plotting of trace metal concentrations in hair. (Jerome - Vanderbilt)

W73-11308

CATION EXCHANGE SEPARATION OF METAL IONS WITH POTASSIUM CHLORIDE-CHELATING AGENT-ORGANIC SOLVENT MEDIUM,

Yonsei Univ., Seoul (Republic of Korea). Dept. of Chemistry.

K. S. Lee, D. W. Lee, and S. W. Kang. Analytical Chemistry, Vol 43, No 7, p 876-879, June 1971. 3 fig, 5 tab, 7 ref.

Descriptors: *Cation exchange, *Potassium, *Chelation, *Metals, Separation techniques, Chemical analysis, Ions, Hydrogen ion concentration, Chemical reactions, Industrial wastes.

Identifiers: Metal ions, Potassium chloride, Organic solvents.

The cation exchange behavior of several metal ions toward Dowex 50W-X8,K (+) form, has been investigated in KCl-methanol or KCl CHELATING agent-organic solvent medium as an eluent. Distribution coefficients and volume distribution coefficients in these media have been measured. By the addition of a chelating agent, such as salicylic and sulfosalicylic acid, and glycine, several separations of the synthetic mixtures were performed successfully. (Oleszkiewicz-Vanderbilt)

W73-11311

OPERATION OF THE ANALYTICAL METHODOLOGY INFORMATION CENTER,

Battelle Columbus Labs., Ohio.

R. L. Little, and R. L. Darby.

Copy available from GPO Sup Doc as EPI.23/5:73-011, \$2.35; microfiche from NTIS as PB-221 491, \$0.95. Environmental Protection Agency, Monitoring Series Report, EPA-R4-73-011, April 1973. 162 p, 9 fig, 16 tab, 3 ref. EPA Project 16020 HJE. 68-01-0166.

Descriptors: *Information retrieval, *Data collections, *Analytical techniques, Methodology, Automation, Digital computers, Publications, *Bibliographies, Toxicity, Data storage and retrieval, Data processing, Pollutant identification.

Identifiers: *Information centers, Information storage and retrieval systems, Interactive information systems.

Details are given for the first year of full-scale operation of the Analytical Methodology Information Center which was designed to collect, process, and disseminate information on analytical methods related to aquatic and marine environments for the Analytical Quality Control Laboratory and other elements of the National Analytical Methods Development Research Program. The main activities of the Center included an extensive acquisitions program, abstracting and indexing at the rate of about 200 items per month, providing abstracts to the Water Resources Scientific Information Center, publication of an abstract bulletin, maintenance of a computerized information/data base which is on-line interactive, provision of

limited loan and copy services, and availability of quick response inquiry services. The value of the interactive information/data base has been further enhanced by the addition of chemical effects (toxicity) data. An additional study was conducted to evaluate the usefulness of SDI services to selected staff members as a means of broadening the AMIC screening process. An extensive group of EPA staff has been served by the Center via the abstract bulletin, the interactive information/data base, the loan and copy services, and the quick response inquiries. Because of interest in these activities outside EPA, plans are underway to permit access to these services on a cost-recovery basis. Recommendations are included for continued operation of the Center. (See also W72-01994) (EPA)

W73-11336

INTERACTION OF NITRILOTRIACETIC ACID WITH SUSPENDED AND BOTTOM MATERIALS,

National Bureau of Standards, Washington, D.C. Analytical Chemistry Div.

J. K. Taylor, R. Alvarez, R. A. Paulson, T. C. Rains, and H. L. Rock.

Copy available from GPO Sup Doc as EPI.16:16020 GFR 07/71, \$0.45; microfiche from NTIS as COM-72-50572, \$0.95. EPA Water Pollution Control Research Series, July 1971. 31 p, 12 tab, 8 ref. EPA Project 16020 GFR.

Descriptors: *Detergents, *Absorption, Analytical techniques, *Neutron activation analysis, *Nitrilotriacetic acid, Pollutant identification, *Bottom sediments, *Suspended solids, Trace elements, Solubility.

An experimental investigation was made of the possible interaction of residual concentrations of nitrilotriacetic acid in surface waters with metallic elements contained in sediments and bottom materials. Samples of bottom materials from typical bodies of surface waters were analyzed for their major, minor, and trace constituents. Eight representative samples of these were equilibrated with distilled water and with water containing 20 ppm of NTA and the resulting solutions were analyzed by three analytical techniques. Elements showing essentially no increased solubility in the presence of NTA were: barium, antimony, molybdenum, strontium, chromium, silver, tin, iron, lead, cadmium, copper, and mercury. Elements showing small increases in solubility were: nickel, zinc, manganese, and cobalt. Calcium and magnesium concentrations were increased somewhat above their normal relatively high concentrations. (EPA)

W73-11339

PHOTOGRAPHIC WATER CONSERVATION AND RECLAMATION PROCESSES STUDY,

Eastman Kodak Co., Rochester, N.Y.

J. W. Gibson.

Available from NTIS, Springfield, Va 22151 as AD-752 220 Price \$3.00 printed copy; \$0.95 microfiche. Air Force Avionics Laboratory Report AFAL-TR-72-273, Wright-Patterson Air Force Base, May 1972. 92 p, 14 fig, 8 tab. USAF Contract F33615-71-C-1353.

Descriptors: *Aerial photography, *Films, *Photography, Physical properties, Research and development, Laboratory tests, Testing procedures, Water quality, Materials testing, Technology, Research equipment, Water pollution effects.

Identifiers: *Photo-film processing, Film storage time, Deleterious photographic effects.

The usability characteristics were determined for black-and-white aerial reconnaissance and duplicating film under conditions of minimal washing and under less than optimum storage temperatures and humidity. Also, the amount of washing

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

needed was determined for a Kodak Versamat Film Processor, Model 11C-M, to obtain film quality that is consistent with the needs of tactical aerial reconnaissance. For this purpose, the wash section of a Versamat Film Processor was modified to demonstrate operation with reduced water supply. The effect on photographic chemicals of contaminants normally found in water was investigated, and test procedures for evaluating the suitability of water for photographic processing were developed. Water quality studies showed that among the potential water contaminants studied deleterious photographic effects for black-and-white processing are caused by (1) high calcium hardness, (2) sulfides, and (3) elemental sulfur. (Woodard-USGS)
W73-11403

INVESTIGATIONS INTO THE OCCURRENCE OF COLIFORM ORGANISMS FROM PRISTINE STREAMS,
Michigan State Univ., East Lansing. Dept. of Microbiology.
For primary bibliographic entry see Field 05B.
W73-11428

THE RELATIONSHIP OF ENZYME KINETIC HETEROGRAPHY ANALYSIS TO OTHER EUTROPHICATION INDICES,
Utah State Univ., Logan. Dept. of Wildlife Science.
For primary bibliographic entry see Field 05C.
W73-11432

STANDARD DISPERSANT EFFECTIVENESS AND TOXICITY TESTS,
Edison Water Quality Research Lab., N.J.
L. T. McCarthy, Jr., I. Wilder, and J. S. Dorrier.
Copy available from GPO Sup Doc as EPI.23/2-73-201, \$0.90; microfiche from NTIS as PB-221 548, \$0.95. Environmental Protection Technology Series Report EPA-R2-73-201, May 1973. 57 p, 5 fig, 12 tab, 6 ref.

Descriptors: *Oil pollution, Standards, *Bioassay, *Toxicity, Emulsifiers, *Testing, Dispersion.
Identifiers: *Dispersant tests, *Dispersant toxicity tests.

A brief history of the development of the Standard EPA Dispersant Effectiveness and Toxicity tests is outlined. The standard tests are presented and discussed. An analysis of variance is performed on the data developed by three independent laboratories in order to determine the reproducibility of standard test procedures. In the standard effectiveness test, oil is applied to the water surface in a cylindrical tank. Dispersant is applied in a fine stream and then mixing energy is supplied by a pressurized water stream. The tank contents are recirculated after which samples are withdrawn for extraction and spectrophotometric analysis. The standard toxicity test involves exposing three species (*Pimephales promelas*, *Fundulus heteroclitus*, and *Artemia salina*) to dispersant and oil/dispersant mixtures. From these tests a curve relating organism survival to material concentrations is developed to determine median tolerance limits. Separate discussion sections include the statistical analyses of 'testing the test' results for reproducibility and the rationale for selecting the test procedures as presented. (EPA)
W73-11442

ADSORPTION OF CHLORINATED HYDROCARBONS FROM SEAWATER BY A CROSSLINKED POLYMER,
Woods Hole Oceanographic Institution, Mass.
G. R. Harvey.

Copy available from GPO Sup Doc as EPI.23/2-73-177, \$0.55; microfiche from NTIS as PB-213 954, \$0.95. Environmental Protection Agency Technology Series Report EPA-R2-73-

177, March 1973. 26 p, 2 fig, 1 tab, 10 ref. EPA Project 16020 GCO.

Descriptors: *Adsorption, *DDT, *Polychlorinated biphenyls, Organic compounds, *Resins, *Monitoring, *Chlorinated hydrocarbon pesticides.

A synthetic resin, Amberlite XAD-2, has been evaluated as an adsorption medium for chlorinated hydrocarbons dissolved in seawater. The resin was very efficient and the method was developed into a routine analytical procedure for the monitoring of seawater. (EPA)
W73-11443

PYROGRAPHIC GROSS CHARACTERIZATION OF WATER CONTAMINANTS, Rockwell, Canoga Park, Calif.

I. Lysyj, and P. R. Newton.

Copy available from GPO Sup Doc as EPI.23/2-73-227, \$1.25; microfiche from NTIS as PB-221 551, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-227, May 1973. 94 p, 10 fig, 15 tab, 5 ref. EPA Project 16040 EXD. Contract No. 14-12-802.

Descriptors: *Water pollution, Monitoring, Water analysis, Gas chromatography, *Waste identification, *Pollutant identification.

Identifiers: *Waste source quantification, *Pyrographic methodology.

A hydrochemical instruments and methodology were developed for direct analysis of organic materials in aqueous solutions based on thermal fragmentation followed by gas chromatographic separation and detection of the resulting derivative compositions. The applications of the developed technique to water pollution surveillance, optimization of waste treatment processes, and characterization of natural waters were studied. A recorded pattern of pyrolytically produced fragments for a given water sample reflects the total nature of its organic composition, and can be interpreted and differentiated in a number of ways. Using a priori established calibration patterns for individual components to be found in a mixture, the pattern produced by a mixture can be analyzed mathematically. The system can be calibrated and the data can be interpreted in terms of pure organic compounds, classes of organic materials, or any other arbitrarily defined organic mixtures such as those found in industrial waste effluents. Application of this technique to pollution surveillance is based on the fact that each industry has a waste whose chemical composition is distinctive to its operation. The uniqueness of such waste compositions offers a means for their characterization as separate entities, rather than as a collection of various chemical species. The validity of this postulate was experimentally demonstrated. With this method, both the identity of the source and the quantity of the waste contributed by each source could be determined. (EPA)
W73-11446

A FLOW PROPORTIONAL COMPOSITE SAMPLER,

Wisconsin State Univ., Platteville.

H. J. Jebens, and R. H. Thomas.

Water and Sewage Works, Vol 117, No 9, p 326-327, September 1970. 2 fig.

Descriptors: Sampling, *Water sampling, Waste water treatment, Treatment facilities, Pumps, *Flow measurement, Flow rates, Domestic wastes, Pollution abatement, Wisconsin.
Identifiers: Sensors, Submersible pumps, *Sampling equipment, *Flow proportioning.

In a recent study of a number of small waste water treatment plants in Wisconsin, a versatile sampling device was developed for use in small plants where some type of flow metering was available. It

was desirable to develop a device which was: (1) fully automatic; (2) easy to install; (3) free from maintenance; (4) adaptable to small treatment plants; (5) capable of flow proportioning a sample; and (6) inexpensive. The sampler developed consists of four component parts: a submersible sampling pump, a sample diversion box, an electronic timer and a sensor mated to the counter of the treatment plant flow totalizer. The sampler, including pumps, extension cords, and sample bottles, cost less than \$200.00 to build and provided up to three individual sampling points at a given treatment plant. Experience over a nine month period has indicated that the system is accurate, maintenance free and reliable for the sampling of domestic waste waters. (Campbell-NWWA)
W73-11463

DETERMINATION OF CARBOHYDRATE IN LAKE SEDIMENT BY A MODIFIED PHENOL-SULFURIC ACID METHOD,

Department of the Environment, Burlington (Ontario), Centre for Inland Waters.

D. Liu, P. T. S. Wong, and B. J. Dutka.
Water Research, Vol 7, No 5, p 741-746, May 1973. 4 fig, 9 ref.

Descriptors: *Carbohydrates, *Lake sediments, *Chemical analysis, *Spectrophotometry, *Methodology, Sampling, Color reactions, Aquatic soils, Soil analysis, Assay, Cores, Phenols, Lake Erie, Lake Ontario, Chemical reactions.

Identifiers: *Phenol-sulfuric acid method, Sample preparation, Reproducibility, Sensitivity, Chemical interference, Absorbance.

A spectrophotometric method for the assay of carbohydrates in lake sediments and soil is described that is based on the measurement of color development in phenol-sulfuric acid at 485 nm. Sediment core samples were taken with a Benthos corer from Lake Erie and Lake Ontario, stored at 4°C and extruded within 48 h of collection. Samples (10 g) from each subsection (0-2, 5-7, 10-12, and 20-22 cm) were processed immediately for carbohydrate and dry weight determination. Dry weights were obtained by heating the sample overnight at 105°C. Distilled water and phenol solution were added to a 2.50 mg wet weight sample and thoroughly mixed. Concentrated H₂SO₄ was added to the mixture which was subsequently allowed to stand at room temperature for 10 minutes. It was centrifuged for another 10 minutes and carbohydrate determinations were made as stated above. Studies of the effects of phenol and carbohydrate on the method showed 100 mg phenol/sample and 0-100 micrograms carbohydrate gave the best results. This highly reproducible and sensitive assay technique requires only 20 minutes and as little as 2 mg wet weight of sample. (Holman-Battelle)

W73-11482

ULTRAPURITY IN TRACE ANALYSIS, Belle Labs, Murray Hill, N.J.

J. W. Mitchell.

Analytical Chemistry, Vol 45, No 6, p 492-500, May 1970. 6 fig, 5 tab, 62 ref.

Descriptors: *Analytical techniques, *Trace elements, Reviews, Laboratory equipment, Water analysis, Neutron activation analysis, Gas chromatography, Air pollution, Manganese, Nickel, Copper, Cobalt, Chromium, Zinc, Iron, Sulfur, Heavy metals, Polarographic analysis.

Identifiers: *Quality control, *Chemical interference, *Reagents, *Ultrapure water, *Blanks, Sample preparation, Detection limits, Stable isotope dilution, Nuclear track counting, Anodic stripping voltammetry, Electron capture gas chromatography, X-ray fluorescence, Optical fluorescence, Spectrophotofluorometry, Atomic absorption spectrophotometry, Vanadium.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

An attempt is made to provide a current reference for analytical chemists, materials scientists, and others responsible for the preparation or practical characterization of ultrapure materials. A summary of procedures used for trace analysis and other advances in methods and techniques are presented, major obstacles to extending the limits for determining trace elements are discussed, and developments required in the future are treated. (Little-Battelle) W73-11483

ANODIC STRIPPING VOLTAMMETRY AT A TUBULAR MERCURY-COVERED GRAPHITE ELECTRODE,
Environmental Protection Agency, Athens, Ga.
Southeast Water Lab.
W. R. Seitz, R. Jones, L. N. Klatt, and W. D. Mason.
Analytical Chemistry, Vol 45, No 6, p 840-844, May 1973. 5 fig, 3 tab, 14 ref.

Descriptors: *Water analysis, *Sea water, Calibrations, Electrodes, Flow rates, Measurement, Lead, Cadmium, Copper.
Identifiers: *Anodic stripping voltammetry, *Thallium, Masking, Chemical interference, Tubular mercury-covered graphite electrode, Plating potential, Plating time, Reproducibility, Sensitivity.

A procedure was developed for preparing a tubular mercury-covered graphite electrode (TMCGE) for doing anodic stripping voltammetry (ASV) in a flowing system. The TMCGE was evaluated using thallium in the presence of .01 M EDTA to mask other metals. The effects of varying plating potential, plating time and flow rate on the Tl stripping peak were as theoretically expected, and linear calibrations of Tl peak height vs concentration were obtained over the ranges of 2-10 times 10 to the minus 7 M, 2-10 times 10 to the minus 8 M, and 2-10 times 10 to the minus 9 M at plating times of 3, 8 and 30 minutes, respectively. The current at any point in the tubular electrode with a flowing system is proportional to one over the cube root of the distance from the upstream end of the tube. Since the upstream end of the TMCGE has the highest current density of any point in the tube, impurities accumulate in this region causing this part of the mercury surface to deteriorate more rapidly. (Little-Battelle)
W73-11484

DETERMINATION OF PHENOLS AND AROMATIC AMINES BY DIRECT TITRATION WITH BROMINE IN PROPYLENE CARBONATE,
Alberta Univ., Edmonton. Dept. of Chemistry.
R. D. Krause, and B. Kratochvil.
Analytical Chemistry, Vol 45, No 6, p 844-848, May 1973. 1 fig, 3 tab, 9 ref.

Descriptors: *Volumetric analysis, *Phenols, *Bromine, Organic acids.
Identifiers: *Propylene carbonate, *Aromatic amines, *Stoichiometry, 2-Naphthol, p-Nitrophenol, Salicylic acid, Methyl salicylate, p-Cresol, Thymol, Resorcinol, Cresols, Aniline, p-Nitroaniline, Anthranilic acid, n-Phenylenediamine, p-Toluidine, p-Phenetidine, Amines, Precision, Accuracy.

Propylene carbonate is used as a medium for bromine substitution reactions. A series of aromatic amines and phenols were determined with accuracies of about 1 percent and precisions of a few ppt. A base such as pyridine must be present to accept protons released in the substitutions. Advantages include rapidity of the reactions, solubility of reactants and products, and convenient standardization of bromine with solutions of bromide. The log formation constant of Br₃(-) in propylene carbonate at zero ionic strength is 7.37. (Little-Battelle)
W73-11485

ORGANIC LOADING OF PETENWELL RESERVOIR, WISCONSIN,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 05C.
W73-11486

MASS SPECTROMETRIC IDENTIFICATION OF SOME BIS-2,4-DINITROPHENYLHYDRAZONES,
Southern Regional Research Lab., New Orleans, La.
J. B. Stanley, V. J. Senn, D. F. Brown, and F. G. Dollear.
Applied Spectroscopy, Vol 27, No 2, p 141 March/April 1973. 1 tab, 4 ref.

Descriptors: *Mass spectrometry, Organic compounds.
Identifiers: *Mass spectra, *bis-2,4-Dinitrophenylhydrazones, Glyoxal, Methylglyoxal, Pyruvic aldehyde, Diacetyl 2 3-Pentanedione, 4-Methyl pent-3-ene-2-one-1-al, 2 5-Hexanedione, Methyl vinyl ketone, 4 5-Octanedione, 2-Oxononanone.

Some features are described of mass spectra obtained from the bis-2,4-dinitrophenylhydrazones (2,4-DNPH) of some aldehydes and ketones. The spectra were obtained on a CEC 21-110B mass spectrometer. The presence of M-183 and mass 183 peaks could be diagnostic of bis-2,4-DNPH's, analogous to the characteristic fragmentation peaks of mono-n-aldehyde and n-ketone 2,4-DNPH's. (Little-Battelle)
W73-11487

CARBON DIOXIDE DYNAMICS: A RECORD OF ORGANIC CARBON PRODUCTION, RESPIRATION, AND CALCIFICATION IN THE ENIWETOK REEF FLAT COMMUNITY,
Hawaii Univ., Honolulu. Dept. of Oceanography.
S. V. Smith.
Limnology and Oceanography, Vol 18, No 1, p 106-120, January 1973. 7 fig, 1 tab, 43 ref.

Descriptors: *Primary productivity, *Monitoring, *Hydrogen ion concentration, *Alkalinity, *Marine algae, *Coral, *Respiration, *Carbon dioxide, Reefs, Sea water, Water analysis, Flow rates, Metabolism, Calcium carbonate.
Identifiers: *Calcification, Eniwetok Atoll.

Samples of sea water were collected before and after flowing over the Eniwetok reef flat and analyzed for alkalinity, pH, and carbon dioxide to determine whether CO₂ content could be used to monitor organic carbon production, respiration, and calcification in the marine environment. Changes in pH and alkalinity were used to partition the CO₂ changes into those due to production-respiration and those due to calcification. The results showed that both a transect visually dominated by a mixture of corals and algae and a transect dominated by an algal turf calcified at an average rate of 4,000 g CaCO₃ per square mile per year, with no apparent day-to-night difference. Although nighttime respiration on both transects was 0.12 g C per square mile per hour, the algal transect exhibited a much higher daytime net production rate than did the coral-algal transect (0.72 vs 0.25 g C per square mile per hour). Although little particulate CaCO₃ was removed from the reef flat during these studies, there has been virtually no net CaCO₃ accumulation there over the last several thousand years. The technique applied to flowing water respirometry is demanding on present capabilities of resolution; however, it should be easily applicable in incubation chambers or in natural water, low-flow rate situations. (Little-Battelle)
W73-11488

RECENT DEVELOPMENTS IN THE ANALYTICAL APPLICATION OF UV PHOTOELECTRON SPECTROSCOPY,
University Coll. of Swansea (Wales). Dept. of Chemistry.

D. Betteridge, A. D. Baker, P. Bye, S. K. Hasanuddin, and N. R. Kemp.
Zeitschrift für Analytische Chemie, Vol 263, No 4, p 286-290, March 1973. 5 fig, 11 ref.

Descriptors: *Data processing, *Computer programs, Laboratory equipment, Gas chromatography, Chlorides.
Identifiers: *UV-photoelectron spectroscopy, *Sample inlet, *GC-photoelectron spectroscopy, Acetone, Solvents, Organic solvents, Hydrochloric acid, Phosphorus pentachloride, Phosphorus oxychloride.

Preliminary results are reported from a number of new developments designed to make UV photoelectron spectroscopy analytically advantageous. A versatile photoelectron spectrometer with a simple sample inlet system has been constructed. This has been successfully linked to a G.L.C. and in this combination serves either to provide a spectrum of the sample or acts as a selective G.C. detector. Data processing has been improved with aid of a computer program which enables the spectrum of a mixture to be resolved into its components. The system was tested with acetone, PC15, POC15, and HCl. (Little-Battelle) W73-11489

FERROUS IRON AND THE GROWTH OF TWENTY ISOLATES OF PHYTOPHTHORA INFESTANS IN SYNTHETIC MEDIA,
West Virginia Univ., Morgantown. Div. of Plant Sciences.

V. M. Cuppett, and V. G. Lilly.
Mycologia, Vol 65, No 1, p 67-77, January-February, 1973. 3 tab, 25 ref.

Descriptors: *Cultures, *Growth rates, Iron, Aquatic fungi.
Identifiers: *Culture media, *Phytophtora infestans.

Twenty isolates of Phytophtora infestans grew well in a D-glucose-L-asparagine medium containing 1.0 ppm of ferric iron provided that 200mg/liter of L-ascorbic acid were added. Under these conditions ferric iron was reduced to the ferrous state. Most of the isolates ferric iron after variable periods of incubation. Growth in media not containing L-ascorbic acid was associated with the reduction of ferric iron. (Little-Battelle) W73-11490

ACQUISITION AND REDUCTION OF GAS CHROMATOGRAPHIC DATA USING A COMPUTER,
Società Italiana Resine S.P.A., Sassari (Italy). Laboratorio Chimico.
M. Greco, and G. Marranci.
Journal of Chromatography, Vol. 77, No 1, p 91-96, March 14, 1973. 4 tab.

Descriptors: *Gas chromatography, *Computers, Carbon dioxide, Nitrogen, Oxygen, Hydrogen, Laboratory equipment, Computer programs, Automation.
Identifiers: *Data reduction, Alkyl benzenes, Xylene, Paraffins, Dichloroethane, Naphtha, Olefins, Carbon monoxide, Chlorinated hydrocarbons, Chromatograms.

Installation is described of an IBM 1800 computer system for the on-line acquisition and reduction of data from twenty gas chromatographs. Gas chromatographs from various manufacturers that use both packed and capillary columns and thermal conductivity and flame ionization detection were interfaced to the computer. The gas chromatography computer system has been used for a wide range of applications, from routine analyses to research and development. The accuracy and repeatability of quantitative data and retention times are shown. Routine analyses were run on C1-C5 gases, alkylbenzenes, p-xylene oxidation products, n-paraffins, pyrolysis samples, H₂, O₂,

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

N₂, CO, CO₂, aromatics, halogenated compounds from 1,2-dichloroethane, naphtha, and olefins. The computer installation required particular studies on the layout of signal cables from the gas chromatography laboratory, of electric cables and of pneumatic lines. (Little-Battelle) W73-11491

LOW COST MULTICHANNEL SCANNING PH-STAT,

Groningen Rijksuniversiteit (Netherlands). Dept. of Microbiology; and Groningen Rijksuniversiteit (Netherlands). Central Electronics Service. J.G. Kuene, P. Cuperus, and W. Harder.

Laboratory Practice, Vol 22, No 1, p 36-38, January 1973. 3 fig, 3 ref.

Descriptors: *Cultures, *Hydrogen ion concentration, *Control systems, *Automatic control, Microbiology, Bacteria, Laboratory equipment, Design.

Identifiers: *pH stat.

A scanning pH-stat is described which can control the pH in 12 cultures. The instrument consists of a commercial on/off pH controller connected to a generator giving a pulsating DC voltage which operates a magnetic valve. Opening the valves results in either the addition of alkali or acid to the culture. The scanner functions as a multiposition switch connecting a specific pH electrode to the corresponding magnetic valve. Depending on the capacity of the switch any number of electrodes and magnetic valves can be accommodated. In the system constructed, 12 positions were used. A time basis generator operates a solenoid which actuates the 12 position switch to monitor each culture and provide pH correction. The scanner has been essentially trouble free during more than two years of operation. (Little-Battelle)

W73-11492

COMPARISON OF SELECTIVE ION MONITORING AND REPETITIVE SCANNING DURING GAS CHROMATOGRAPHY-MASS SPECTROMETRY,

Baylor Coll. of Medicine, Houston, Tex. Inst. for Lipid Research.

B. S. Middleitch, and D. M. Desiderio. Analytical Chemistry, Vol 45, No 4, p 806-808, April 1973. 2 fig, 1 tab, 19 ref.

Descriptors: *Laboratory tests, Methodology, Chemical analysis, Organic compounds.

Identifiers: *Selective ion monitoring, *Repetitive scanning, *Sensitivity, *Versatility, *GC-Mass spectrometry, Biochemical analysis, Method evaluation, Mass spectra, Cholestan, Accuracy, Trace levels.

Because of the increasing applicability of repetitive scanning (RS) and selective ion monitoring (SIM) gas chromatography-mass spectrometry to biochemical problems, an investigation using cholestan as a test substance was carried out to determine the relative sensitivities, limitations and versatilitys of the two methods. Three-microliter aliquots of cholestan stock solution diluted by a factor of 10 from 10 to 1,000,000 times were used for GC-MS to facilitate accuracy of injection volumes. The results indicate that, under similar conditions, the RS and SIM methods provide similar sensitivities. Under the optimum conditions for each method, SIM is capable of far greater sensitivity. The choice of technique to be used depends, to a great extent, on the availability of facilities for automated data handling. The SIM method is preferable for the detection and measurement of trace quantities. (Holoman-Battelle) W73-11493

POPULATION STUDIES OF THREE AQUATIC GASTROPODS IN AN INTERMITTENT BACKWATER,

Cornell Univ., Ithaca, N.Y. Dept. of Entomology.

J. W. Eckblad.

Hydrobiologia, Vol 41, No 2, p 199-219, March 29, 1973. 4 fig, 9 tab, 40 ref.

Descriptors: *Snails, *Dry beds, *Standing crops, *Productivity, Biomass, Backwater, On-site investigations, Population, Invertebrates, Drought, Tolerance, Dry seasons.

Identifiers: *Survival, *Lymnaea palustris*, *Phasina integra*, *Gyraulus parvus*, Macroinvertebrates, Turnover ratio.

Three snail populations of an intermittent backwater were studied over a 20-month period, and estimates were made of rate of population change, mean biomass, annual and summer net production, and survival under conditions of little standing water. *Lymnaea palustris* and *Phasina integra* populations were essentially univoltine, while *Gyraulus parvus* appeared to produce several generations during the year. *L. palustris* formed a protective epiphagm and was apparently better suited to recurrent dry periods than either *G. parvus* or *P. integra*. The population density of *G. parvus* was usually well below, and more aggregated, than the other two species. The estimated annual production rates for *L. palustris* and *P. integra* were 2.18 g/sq m and 1.59 g/sq m, respectively, and these two species accounted for about 98 percent of the total gastropod production. About 75.9 percent and 66.5 percent of the *L. palustris* and *P. integra* production, respectively, occurred between June and November. Summer turnover ratios in 1969 were 4.69 for *L. palustris* and 2.94 for *P. integra*. An extended dry period early in the summer of 1970 reduced total snail production to about 18-24 percent of that of the previous season, although summer turnover ratios were fairly consistent. (Little-Battelle)

W73-11494

SPECTROPHOTOMETRIC METHOD FOR DETERMINATION OF OZONE IN AQUEOUS SOLUTIONS,

Hadassah Medical School, Jerusalem (Israel).

H. Shechter. Water Research, Vol 7, No 5, p 729-739, May 1973. 5 fig, 3 tab, 24 ref.

Descriptors: *Spectrophotometry, *Ozone, *Methodology, *Kinetics, *Aqueous solutions, *Pollutant identification, *Water analysis, Oxidation, Viruses, Volumetric analysis, Chemical analysis, Chemical reactions, Disinfection, Bacteria, Water temperature, Cultures.

Identifiers: *Inactivation, Reproducibility, Dissolved gases, Sensitivity, Mast reagent, Method evaluation, Mass spectra, Cholestan, Accuracy, Trace levels.

A sensitive spectrophotometric method for determination of ozone in small volumes of water was performed in order to meet the requirements of a kinetic study of virus and bacteria inactivation by ozone. The proposed method involves oxidation of a buffered iodine solution and spectrophotometric measurement of the triiodide ion liberated by ozone. Two procedures are used: one for low ozone concentration (0.01-0.30 ppm) and another for higher concentrations (0.30-2.0 ppm). In order to establish the precision of the proposed method, 6 parallel determinations were carried out, in a consecutive order, at different O₃ concentrations (0.05-0.33 ppm and 0.23-1.92 ppm). Reproducibility was very high when the procedure used corresponds with the ozone level for which it was intended. The comparative results obtained from ozone determinations by spectrophotometry using neutral KI reagent or Mast reagent, and by the standard volumetric method showed the volumetric readings to be greater than those of spectrophotometry. Some applications of the method for a kinetic study of virus inactivation by ozone are presented and the optimal conditions for such applications have been established. (Holoman-Battelle) W73-11495

PROGRESS REPORT OF RESIDUE STUDIES ON ORGANIC ARSENICALS USED FOR DITCHBANK WEED CONTROL,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 04A.
W73-11497

FALLING-DROP TECHNIQUE FOR SILT-CLAY SEDIMENT ANALYSIS,

Wisconsin Univ., Green Bay. Coll. of Environmental Sciences.

J. M. Pezzetta. Available NTIS, Springfield, Va. 22151 as COM-73-10228 Price \$3.00 printed copy; 95 cents microfiche. Wisconsin University Sea Grant Technical Report WIS-SG-72-215, July 1972. 204 p, 7 fig, 1 tab, 87 ref, append.

Descriptors: *Sediments, *Particle size, *Silts, *Clays, Analytical techniques, Settling velocity, Laboratory tests, Particle shape, Sedimentology, Sediment transport.

Identifiers: Sediment analysis.

The falling drop method for analyzing the textural characteristics of silts and clays down to a particle diameter of about 1 micron is presented as a tractable laboratory procedure for routine investigations of fine-grained sediments. Size classification is based on the calculated settling times of sedimentary particles using either Wadell's formula or Stokes' law, the former being preferred since it allows for the effects of grain shape on the settling velocity. The weights or concentrations associated with each class interval sampled at the corresponding settling times are determined on the basis of the fall time of a drop of sediment suspension in a nonmiscible organic fluid. The latter procedure represents a substantial improvement over the standard pipetting technique in that it obviates the need for weighing and drying aliquot samples. Additional information includes formulas, settling times, and other data normally required in a sedimentology laboratory but which are generally scattered throughout the literature or in several handbooks. (Woodard-USGS) W73-11558

CONTINUOUS CULTURE OF RHODOTORULA RUBRA: KINETICS OF PHOSPHATE-ARSENATE UPTAKE, INHIBITION, AND PHOSPHATE-LIMITED GROWTH,

Alaska Univ., College, Inst. of Marine Science.

D. K. Button, S. S. Dunker, and M. L. Morse. Journal of Bacteriology, Vol 113, No 2, p 599-611, February 1973. 8 fig, 5 tab, 38 ref.

Descriptors: *Kinetics, *Phosphates, *Absorption, *Hydrogen ion concentration, Inhibition, Growth rates, Nutrient requirements, Yeasts, Cultures, Radioactivity techniques, Bioassay, Toxicity, Equations, Sodium chloride, Population.

Identifiers: *Rhodotorula rubra, *Electron transport, Arsenates, Bioaccumulation, Scintillation counting, P-32, As-73.

The kinetics of phosphate uptake, growth limitation, and inhibition of arsenate transport in Rhodotorula rubra are described in view of their relevance to microbial processes in dilute aquatic environments. *R. rubra* is a pink yeast which was recently isolated from sea water and is able to grow in continuous culture systems at low pH and at low phosphate concentrations. Population density averages were determined from routine plate counts and with a model B Coulter counter. Uptake rates were determined by scintillation counts of P-32-labelled phosphorus; arsenate was determined by As-73 labelling. The yeast was capable of extended growth at very low phosphate concentrations (Concentration at one half maximal growth rate was 10.8 nanomoles). Average intracellular phosphate concentrations, based on isotope exchange techniques, were 15 to 200 micromoles, giving concentration gradients across the cell envelope of about one million. Inability of the

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

phosphate transport system to discriminate against arsenate transport led to arsenate toxicity at 1 to 10 nanomoles. Phosphate competitively prevented arsenate toxicity. Phosphate uptake experiments showed that maximal growth rates could be achieved with approximately 4 percent of the total phosphate-arsenate transport system. Organisms adapted to a range both of concentration of NaCl and of pH. Phosphate initial uptake rates that were in agreement with the steady-state flux in continuous culture were obtained by using organisms and medium directly from continuous culture. This procedure resulted in rates about 500 times greater than one in which harvested batch-grown cells were used. Growth could not be sustained below a threshold phosphate concentration of 3.4 nanomoles. Equations are presented for evaluation of growth rate-limiting substrate concentrations in the presence of background substrates and for evaluating low inhibitor concentration inhibition mechanisms by substrate prevention of inhibitor flux. (Little-Battelle)
W73-11574

PETROLEUM HYDROCARBONS AND FATTY ACIDS IN WASTEWATER EFFLUENTS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05B.
W73-11575

TOTAL MERCURY AND METHYLMERCURY CONTENT OF THE AMERICAN EEL (ANGUILLA ROSTRATA),
Fisheries Research Board of Canada, Halifax (Nova Scotia). Halifax Lab.
For primary bibliographic entry see Field 06C.
W73-11576

MERCURY, DDT, AND PCB IN HARBOUR SEALS (PHOCA VITULINA) FROM THE BAY OF FUNDY AND GULF OF MAINE,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W73-11577

THE SEASONAL CYCLE OF VITAMIN B12 IN THE STRAIT OF GEORGIA, BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Inst. of Oceanography.
For primary bibliographic entry see Field 02L.
W73-11578

RESIDUES OF CHLORINATED HYDROCARBON PESTICIDES IN THE NORTHERN QUAHOG (HARD-SHELL CLAM), MERCEENARIA MERCEENARIA-1968 AND 1969,
Rhode Island Dept. of Health, Providence. Div. of Labs.
For primary bibliographic entry see Field 03C.
W73-11579

DDT, DDE, AND POLYCHLORINATED BIPHENYLS IN BIOTA FROM THE GULF OF MEXICO AND CARIBBEAN SEA-1971,
Texas A and M Univ., College Station. Dept. of Chemistry.
For primary bibliographic entry see Field 05B.
W73-11580

PRELIMINARY REPORT, (RV THOMAS G. THOMPSON CRUISE 66),
Washington Univ., Seattle. Dept. of Oceanography.

S. Campbell, T. Owens, and R. M. Millar.
Available from the National Technical Information Service as AD-754 843, Report Nos. PCR-66, Ref-M72-28, May 1972. 9 p, 1 fig, 9 ref. Project No. NR 083 012, Contract No. N-0014-67-A-0103-0014, Grant No. NSF-GA-24875.

Descriptors: *Denitrification, *Sea water, *Nitrates, *Chlorophyll, *Respiration, Nitrites, Nitrogen, Pacific Ocean, Water analysis, Zooplankton, Phytoplankton, Dissolved oxygen, Salinity, Phosphates, Ammonia, Sampling, Chemical analysis, Sediments, Methodology, Water pressure, Water temperature.
Identifiers: *Electron transport, Transport, RV Thomas G. Thompson, Organic nitrogen, Organic carbon.

W73-11583

NUTRIENT INVERSIONS IN THE SOUTHEASTERN TROPICAL PACIFIC OCEAN,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 02L.
W73-11587

Cruise 66 of the Thomas G. Thompson was the sixth in a series of cruises to the oxygen deficient waters of the eastern tropical North Pacific Ocean. The major objectives of the cruise were to: (1) Provide information on the variability of the transport of the products of denitrification out of the oxygen deficient region and determine the magnitude of the transport of these products by the California Undercurrent. (2) Provide nitrate and nitrite data from a number of areas where such information was previously unavailable. (3) Determine whether or not gaseous nitrogen is the main sink for the nitrate consumed during denitrification by the precise measurement of N/Ar and N-14/N-15 ratios, dissolved and particulate organic nitrogen, nitrate and nitrite. (4) Estimate respiration rates by obtaining profiles of the activity of the respiratory electron transport system both as a function of depth and latitude. (5) Determine the effects of pressure and temperature on the electron transport system, and (6) Obtain depth profiles of chlorophyll in plankton. The methods employed for the analyses are briefly described. However, no data are included. (Little-Battelle)
W73-11583

ANALYSIS OF SEA WATER BY DIFFERENCE CHROMATOGRAPHY. SUMMARY OF PROGRESS 1972,

Woods Hole Oceanographic Institution, Mass.
Dept. of Chemistry.
P. C. Mangelsdorf, Jr., and W. M. Chang.
Available from the National Technical Information Service as COO-3119-1, Report 1972. 27 p, 11 fig, 17 ref, 2 append. Contract No. AEC AT (11-1)-3119.

Descriptors: *Water analysis, *Connate water, *Ion exchange, Sulfates, Calcium, Sodium, Magnesium, Potassium, Carbonates, Chromatography, Sampling, Laboratory equipment, Atlantic Ocean, Salinity, Hydrogen ion concentration, Chlorides, Sea water.
Identifiers: *Difference chromatography, *Sampling.

During the past year the principal new developments in work with Difference Chromatography have been: (1) Design and construction of a sturdy model of an in situ interstitial water sampler for collecting undisturbed pore water samples from marine sediments, (2) Successful use of this instrument at 24 locations across the North Atlantic on the Cork-Woods Hole leg of the RV CHAIN cruise 103, (3) Discovery that the water samples collected in-situ are dramatically different from ordinary sea water and also different from what was expected, (4) Analysis of a suite of South Atlantic sea water samples taken with close vertical spacing, (5) Overhaul and reconstruction of two existing Difference Chromatographs to improve their reliability, (6) Design and construction of a new separate dual column Difference Chromatograph to permit further development work on anion analysis, resolution and sensitivity, etc., without interruption of the analytical program, (7) Further work on the reaction of fluvial sediments with sea water, probably resolving earlier discrepancies in the extent of ion exchange. (Little-Battelle)
W73-11584

MERCURY IN PUBLIC SEWER SYSTEMS,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 05D.

MERCURY IN HARBOUR PORPOISES (PHOCOENA PHOCOENA) FROM THE BAY OF FUNDY REGION,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W73-11588

OXYGEN DEFICIENT CONDITIONS AND NITRATE REDUCTION IN THE EASTERN TROPICAL NORTH PACIFIC OCEAN,
Washington Univ., Seattle. Dept. of Oceanography.

J. D. Cline, and F. A. Richards.
Limnology and Oceanography, Vol 17, No 6, p 885-900, November 1972. 9 fig, 6 tab, 46 ref.

Descriptors: *Pacific Ocean, *Dissolved oxygen, *Nitrates, *Nitrites, *Reduction (Chemical), *Denitrification, *Cycling nutrients, *Deficient elements, Water analysis, Salinity, Water temperature, Phosphates, Ammonia, Silicates, Hydrogen ion concentration, Iron, Alkalinity, Carbon dioxide, Hydrogen sulfide, Sulfites, Chemical analysis, Gas chromatography, Distribution.
Identifiers: On board analysis, Nitrous oxide, Sulfites, Thiosulfate.

The purpose was to relate the distributions of dissolved oxygen and compounds of nitrogen and phosphorus in the oxygen-minimum zone of waters off Mexico and Central America to the effects of oxygen deficiencies on nitrate reduction, denitrification, and attendant microbiological processes occurring there. Chemical and physical observations included salinity, temperature, dissolved oxygen (Winkler and colorimetric), inorganic phosphate, nitrate, nitrite, nitrous oxide, ammonia, silicate, pH, alkalinity, total carbon dioxide, dissolved hydrogen sulfide, sulfite, thiosulfate, and soluble and particulate iron. On a second cruise, nitrate, nitrite, ammonia, phosphate, and silicate determinations were carried out on a Technicon AutoAnalyzer. Oxygen concentrations in the oxygen-minimum zone were commonly less than 1 microgram-atom/liter from below the pycnocline to depths of several hundred meters. In these nearly anoxic waters, nitrate appears to be reduced to nitrite and free nitrogen. Nitrate deficits, derived from material balance calculations, suggest that up to 13-14 microgram-atoms/liter (40-50 percent) of nitrate-nitrogen have been so reduced. Secondary nitrite concentrations rarely exceed 1.5 microgram-atoms/liter and are generally associated with oxygen concentrations of less than 2 microgram-atoms/liter. Ammonia concentrations appear to be slightly lower in the region of denitrification, probably because of bacterial assimilation. It is estimated that about 230 x 10 to the twelfth power grams of combined N are lost annually by denitrification. (Little-Battelle)
W73-11589

A NEW CRAYFISH OF THE SUBGENUS JUGICAMBARUS FROM TENNESSEE WITH AN EMENDED DEFINITION OF THE SUBGENUS (ASTACIDAE, DECAPODA),
Tennessee Univ., Knoxville. Dept. of Zoology and Entomology.

R. W. Bouchard.
The American Midland Naturalist, Vol 89, No 1, p 103-111, January 1973. 1 fig, 1 tab, 10 ref.

Descriptors: *Crustaceans, *Speciation, *Crayfish, Invertebrates, Tennessee, Ecology, Distribution, Color, Aquatic animals, Life cycles.

WATER QUALITY MANAGEMENT AND PROTECTION—Field

Identification of Pollutants—Group 5A

Identifiers: *Jugicambarus*, Macroinvertebrates, Decapods, Arthropods, *Cambarus* (*Jugicambarus*) *crinipes*, *Cambarus* *crinipes*.

Cambarus crinipes, a new species of crayfish from the Cumberland Plateau in Tennessee has been described. This new species belongs to the subgenus *Jugicambarus* which has been emended. Color notes, relationships, distribution, life history notes and ecological data are given. A more accurate method of measuring the carapace is proposed and the use of the posterior margin of the epistome as a possible taxonomic structure is introduced. (Holoman-Battelle)

W73-11590

ACUTE AND LONG-TERM ACCUMULATION OF COPPER BY THE BROWN BULLHEAD, *Ictalurus nebulosus*, National Water Quality Lab., Duluth, Minn. For primary bibliographic entry see Field 05C.

W73-11593

BIOLOGICAL EFFECTS OF FLUCTUATING WATER LEVELS IN THE SNAKE RIVER, GRAND TETON NATIONAL PARK, WYOMING.

Wyoming Univ., Laramie. Dept. of Zoology and Physiology. For primary bibliographic entry see Field 02E.

W73-11594

PHYSICAL-CHEMICAL OCEANOGRAPHIC DATA FROM THE NORTH PACIFIC OCEAN AND BERING SEA, 1971, National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.

W. J. Ingraham, Jr., D. M. Fisk, C. J. Bartlett, and S. E. Turner.

Available from the National Technical Information Service as COM-73-10192. Data Report 75, February 1973. 172 p, 3 fig, 11 ref.

Descriptors: *Pacific Ocean, *Water temperature, *Depth, *Salinity, *Data processing, Water quality, Computers, Sea water, Density.

Identifiers: *Bering Sea, On board analysis, Sound velocity, RV George B. Kelez.

Temperature and salinity data were obtained in the North Pacific Ocean at 176 stations in 1971 during spring and autumn cruises of the RV George B. Kelez south of the Aleutian Islands, in the Bering Sea, and along the coasts of Washington and British Columbia. Values were obtained from STD traces at standard depths to 1,000 m (spring data) or 1,500 m (autumn data). Computations of density (σ_{sigma} -t), sound velocity, anomaly of specific volume, and dynamic height, which were performed by a shipboard PDP-8 computer, are presented. The autumn data tabulations were obtained automatically through a new computer interface. (Little-Battelle)

W73-11595

MEASUREMENT OF EXCHANGEABLE INORGANIC PHOSPHATE IN LAKE SEDIMENTS, Wisconsin Univ., Madison. Water Chemistry Lab. W. C. Li, D. E. Armstrong, and R. F. Harris. Environmental Science and Technology, Vol 7, No 5, p 454-456, May 1973. 2 tab, 22 ref.

Descriptors: *Phosphates, *Lake sediments, *Methodology, *Measurements, *Pollutant identification, Phosphorus, Phosphorus radioisotopes, Aquatic soils, Soil analysis, Chemical analysis, Nutrients, Radioactivity techniques, Sampling, Oxidation, Reduction (Chemical).

Identifiers: *Sediment-water equilibration systems, Lake Mendota (Wis), Lake Wingra (Wis), Lake Crystal (Wis), Lake Little John (Wis), Tomahawk Lake (Wis), Lake Trout (Wis), Devil's Lake (Wis), Lake Minocqua (Wis).

The amounts of isotopically exchangeable inorganic phosphate in a range of Wisconsin lake sediments were measured in two contrasting (long- and short term) equilibration systems. The systems differed in equilibration times, oxidation-reduction conditions, and the degree of agitation. Total sediment P was determined by Na₂CO₃ fusion, total organic P by the Mehta extraction procedure, and total inorganic P as the difference between total P and total inorganic P. Dissolved inorganic P in sediment extracts and in sediment-water equilibration systems was measured by the method of Murphy and Riley (1962). Levels of total exchangeable inorganic P were similar for the two systems, indicating that the simplified short-term equilibration method was suitable for routine measurements of exchangeable inorganic P. Differences between the two systems in the distribution of exchangeable P between the solid and solution phases were apparently related to differences in oxidation-reduction conditions. Exchangeable inorganic P ranged from 18-65 percent of the total inorganic P in the sediments investigated. (Holoman-Battelle)

W73-11596

EFFECT OF CHLORINE ON FLUORESCENT DYES,

California State Dept. of Public Health, Berkeley. Bureau of Sanitary Engineering. For primary bibliographic entry see Field 05C.

W73-11597

A CYPRINODONTID FISH, *JORDANELLA FLORIDA*, AS A LABORATORY ANIMAL FOR RAPID CHRONIC BIOASSAYS,

National Water Quality Lab., Duluth, Minn. For primary bibliographic entry see Field 05C.

W73-11598

A COLORIMETRIC TECHNIQUE SUGGESTED FOR CHEMICAL OXYGEN DEMAND DETERMINATION,

Jadavpur Univ., Calcutta (India). Dept. of Civil Engineering.

N. Chaudhuri, S. Niyogi, A. De, and A. Basu. Journal Water Pollution Control Federation, Vol 45, No 3, p 537-541, March 1973. 4 fig, 3 tab, 8 ref.

Descriptors: *Chemical oxygen demand, *Methodology, *Colorimetry, *Laboratory tests, Chemical analysis, Waste water (Pollution), Industrial wastes, Domestic wastes, Chemical properties, Organic compounds, Estimating, Carbohydrates, Lipids, Proteins, Organic acids, Alcohols, Amino acids, Correlation analysis, Regression analysis, Volumetric analysis, Water properties.

Identifiers: *Substrates, Data interpretation, Correlation coefficients, Metabolites, Absorbance, Hilger pattern biochemical absorptionmeter, Dextrose monohydrate, Organic solvents, L-glutamic acid, Absorption spectra, α -Butyric acid, Ethyl alcohol, α -Cresol, Alanine, Valine, Acetic acid, Toluene, Lactose, Sucrose, Tyrosine, Glycine, Lactic acid, Citric acid, Tartaric acid, Maleic acid, Oleic acid, Isopropyl alcohol, Benzene, Catechol, m -Cresol, Salicylic acid, Benzoic acid, Pyridine.

The feasibility and consistency of colorimetric estimation of chemical oxygen demand were investigated using a sufficiently large number of chemicals under varying test conditions. Chemicals representing carbohydrates, fats, proteins, and metabolites that are commonly encountered in domestic and industrial waste water were selected as test substances. A Hilger pattern biochemical absorptionmeter (filter type) was used. The investigation revealed a very high degree of consistency between the colorimetric and chemical oxygen demand values, with a correlation coefficient of 0.99 or above in all tests. The method suggested for use consists of (a) selecting the optimum wave length, (b) determining the colorimetric

absorbance on various substrates, and (c) performing a linear regression to calibrate the technique. (Holoman-Battelle)

W73-11599

QUANTITATIVE INFRARED SPECTROPHOTOMETRY OF ORGANIC NITRATE ESTERS,

Picatinny Arsenal, Dover, N.J.

Y. P. Carigan, and C. L. Hickman, IV. Available from the National Technical Information Service as AD-753938. Technical Report No. PA-TR-4350, May 1972. 71 p, 29 fig, 27 tab, 8 ref.

Descriptors: *Nitrates, Organic compounds, *Nitrogen compounds.

Identifiers: *Nitrate esters, *Infrared spectrophotometry, *Infrared spectra, *Organic nitrogen compounds, Ethyl nitrate, Amyl nitrate, Ethylene glycol dinitrate, Glycerol trinitrate, Cellulose nitrate, Absorbance, Organic solvents, Chloroform, Tetrahydrofuran, Quantitative analysis.

W73-11596

A quantitative infrared analysis of the N double bond O asymmetric stretching vibration band for the nitrate esters, ethyl nitrate, amylnitrate, ethylene glycol dinitrate, glycerol trinitrate, and cellulose nitrate (12.53 percent) is presented. Two solvents, spectrograde chloroform and tetrahydrofuran, were used in the preparation of the solutions. For the five nitrate esters studied, Beer's law for the absorbance of the N double bond O asymmetric stretching band was found to be generally obeyed. From a measure of the absorbance one could calculate the amount of a given nitrate ester present in solution. The band shape for cellulose nitrate was significantly broader and consequently measurement of the absorbance at the band maximum was not a true indication of the absorption intensity. A more realistic measurement would be the integrated intensity of the band. (Holoman-Battelle)

W73-11600

MACROBENTHIC ECOLOGY OF A SAWDUST-BEARING SUBSTRATE IN THE PENOBSCOT RIVER ESTUARY (MAINE),

Maine Univ., Orono. Dept. of Zoology.

For primary bibliographic entry see Field 05C.

W73-11602

TRACE ANALYSIS BY ENZYME INHIBITION AND ACTIVATION,

Birmingham Univ. (England).

A. Townsend.

Process Biochemistry, Vol 8, No 3, p 22, 24, March 1973. 1 fig, 3 tab, 40 ref.

Descriptors: *Enzymes, *Pollutant identification, *Inhibition, *Chlorinated hydrocarbon pesticides, *Heavy metals, Potassium, Calcium, Magnesium, Manganese, Zinc, Iron, Molybdenum, Copper, Cobalt, Fluorine, Mercury, Iodine, Sulides, Beryllium, Lead, Aldrin, Heptachlor, DDT, Phosphothioate pesticides, Inhibitors.

Identifiers: *Drugs, Cyanides, Silver, Barium, Indium, Sevin, Lindane, Methyl parathion, Chlordane, Activation, Tetrahydrocannabinol, Morphine sulfate, Sodium phenobarbitone, Sensitivity, Sodium barbitone, Detection limits, Alcohol dehydrogenase, Alkaline phosphatase, Lipase, Invertase, Catalase, Hyaluronidase, Isocitrate dehydrogenase, Acid phosphatases, LSD, Hexokinase, Carbonic anhydrase, Phosphatase, Dehydrogenase.

The use of enzyme inhibition and activation to detect metals, nonmetals, pesticides and drugs is reviewed. Activation techniques have been used to detect K, Ca, Mg, Mn, Zn, Fe, Mo, Cu, and Co. Inhibition methods have been used to detect F, Hg, Ag, I, sulfite, cyanide, Ba, Be, Zn, Cu, Fe, In, Rb, the pesticides aldrin, sevin, lindane, hept-

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

phosphate transport system to discriminate against arsenate transport led to arsenate toxicity at 1 to 10 nanomoles. Phosphate competitively prevented arsenate toxicity. Phosphate uptake experiments showed that maximal growth rates could be achieved with approximately 4 percent of the total phosphate-arsenate transport system. Organisms adapted to a range both of concentration of NaCl and of pH. Phosphate initial uptake rates that were in agreement with the steady-state flux in continuous culture were obtained by using organisms and medium directly from continuous culture. This procedure resulted in rates about 500 times greater than one in which harvested batch-grown cells were used. Growth could not be sustained below a threshold phosphate concentration of 3.4 nanomoles. Equations are presented for evaluation of growth rate-limiting substrate concentrations in the presence of background substrate and for evaluating low inhibitor concentration inhibition mechanisms by substrate prevention of inhibitor flux. (Little-Battelle)

W73-11574

PETROLEUM HYDROCARBONS AND FATTY ACIDS IN WASTEWATER EFFLUENTS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05B.

W73-11575

TOTAL MERCURY AND METHYLMERCURY CONTENT OF THE AMERICAN EEL (ANGUILLA ROSTRATA),
Fisheries Research Board of Canada, Halifax Lab.
(Nova Scotia). Halifax Lab.
For primary bibliographic entry see Field 06C.

W73-11576

MERCURY, DDT, AND PCB IN HARBOUR SEALS (PHOCA VITULINA) FROM THE BAY OF FUNDY AND GULF OF MAINE,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 05C.

W73-11577

THE SEASONAL CYCLE OF VITAMIN B12 IN THE STRAIT OF GEORGIA, BRITISH COLUMBIA,
British Columbia Univ., Vancouver. Inst. of Oceanography.
For primary bibliographic entry see Field 02L.

W73-11578

RESIDUES OF CHLORINATED HYDROCARBON PESTICIDES IN THE NORTHERN QUAHOG (HARD-SHELL CLAM), MERCENARIA MERCENARIA-1968 AND 1969,
Rhode Island Dept. of Health, Providence. Div. of Labs.
For primary bibliographic entry see Field 05C.

W73-11579

DDT, DDE, AND POLYCHLORINATED BIPHENYLS IN BIOTA FROM THE GULF OF MEXICO AND CARIBBEAN SEA-1971,
Texas A and M Univ., College Station. Dept. of Chemistry.
For primary bibliographic entry see Field 05B.

W73-11580

PRELIMINARY REPORT, (RV THOMAS G. THOMPSON CRUISE 66),
Washington Univ., Seattle. Dept. of Oceanography.

S. Campbell, T. Owens, and R. M. Millar.

Available from the National Technical Information Service as AD-754 843, Report Nos. PCR-66, Ref-M72-28, May 1972. 9 p., 1 fig., 9 ref. Project No. NR 083 012, Contract No. N-0014-67-A-0103-0014, Grant No. NSF-GA-24875.

Descriptors: *Denitrification, *Sea water, *Nitrates, *Chlorophyll, *Respiration, Nitrites, Nitrogen, Pacific Ocean, Water analysis, Zooplankton, Phytoplankton, Dissolved oxygen, Salinity, Phosphates, Ammonia, Sampling, Chemical analysis, Sediments, Methodology, Water pressure, Water temperature.
Identifiers: *Electron transport, Transport, RV Thomas G. Thompson, Organic nitrogen, Organic carbon.

W73-11581

NUTRIENT INVERSIONS IN THE SOUTHEASTERN TROPICAL PACIFIC OCEAN,
Scripps Institution of Oceanography, La Jolla, Calif.

For primary bibliographic entry see Field 02L.

W73-11582

MERCURY IN HARBOUR PORPOISES (PHOCENA PHOCENA) FROM THE BAY OF FUNDY REGION,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 05C.

W73-11583

Cruise 66 of the Thomas G. Thompson was the sixth in a series of cruises to the oxygen deficient waters of the eastern tropical North Pacific Ocean. The major objectives of the cruise were to: (1) Provide information on the variability of the transport of the products of denitrification out of the oxygen deficient region and determine the magnitude of the transport of these products by the California Undercurrent. (b) Provide nitrate and nitrite data from a number of areas where such information was previously unavailable. (c) Determine whether or not gaseous nitrogen is the main sink for the nitrate consumed during denitrification by the precise measurement of N/Ar and N-14/N-15 ratios, dissolved and particulate organic nitrogen, nitrate and nitrite. (d) Estimate respiration rates by obtaining profiles of the activity of the respiratory electron transport system both as a function of depth and latitude. (e) Determine the effects of pressure and temperature on the electron transport system, and (f) Obtain depth profiles of chlorophyll in plankton. The methods employed for the analyses are briefly described. However, no data are included. (Little-Battelle)

W73-11583

ANALYSIS OF SEA WATER BY DIFFERENCE CHROMATOGRAPHY. SUMMARY OF PROGRESS 1972.

Woods Hole Oceanographic Institution, Mass. Dept. of Chemistry.

P. C. Mangelsdorf, Jr., and W. M. Chang.
Available from the National Technical Information Service as COO-3119-1, Report 1972. 27 p., 11 fig., 17 ref., 2 append. Contract No. AEC AT (11-1)-3119.

Descriptors: *Water analysis, *Connate water, *Ion exchange, Sulfates, Calcium, Sodium, Magnesium, Potassium, Carbonates, Chromatography, Sampling, Laboratory equipment, Atlantic Ocean, Salinity, Hydrogen ion concentration, Chlorides, Sea water.
Identifiers: *Difference chromatography, *Samples.

During the past year the principal new developments in work with Difference Chromatography have been: (1) Design and construction of a sturdier model of an *in situ* interstitial water sampler for collecting undisturbed pore water samples from marine sediments, (2) Successful use of this instrument at 24 locations across the North Atlantic on the Cork-Woods Hole leg of the R/V CHAIN cruise 105, (3) Discovery that the water samples collected *in-situ* are dramatically different from ordinary sea water and also different from what was expected, (4) Analysis of a suite of South Atlantic sea water samples taken with close vertical spacing, (5) Overhaul and reconstruction of two existing Difference Chromatographs to improve their reliability, (6) Design and construction of a new separate dual column Difference Chromatograph to permit further development work on anion analysis, resolution and sensitivity, etc., without interruption of the analytical program, (7) Further work on the reaction of fluvial sediments with sea water, probably resolving earlier discrepancies in the extent of ion exchange. (Little-Battelle)

W73-11584

MERCURY IN PUBLIC SEWER SYSTEMS,
Illinois State Water Survey, Peoria. Water Quality Section.

For primary bibliographic entry see Field 05D.

OXYGEN DEFICIENT CONDITIONS AND NITRATE REDUCTION IN THE EASTERN TROPICAL NORTH PACIFIC OCEAN,
Washington Univ., Seattle. Dept. of Oceanography.

J. D. Cline, and F. A. Richards.

Limnology and Oceanography, Vol 17, No 6, p 885-900, November 1972. 9 fig., 6 tab., 46 ref.

Descriptors: *Pacific Ocean, *Dissolved oxygen, *Nitrates, *Nitrites, *Reduction (Chemical), *Denitrification, *Cycling nutrients, *Deficient elements, Water analysis, Salinity, Water temperature, Phosphates, Ammonia, Silicates, Hydrogen ion concentration, Iron, Alkalinity, Carbon dioxide, Hydrogen sulfide, Sulfites, Chemical analysis, Gas chromatography, Distribution.
Identifiers: On board analysis, Nitrous oxide, Sulfites, Thiosulfate.

The purpose was to relate the distributions of dissolved oxygen and compounds of nitrogen and phosphorus in the oxygen-minimum zone of waters off Mexico and Central America to the effects of oxygen deficiencies on nitrate reduction, denitrification, and attendant microbial processes occurring there. Chemical and physical observations included salinity, temperature, dissolved oxygen (Winkler and colorimetric), inorganic phosphate, nitrate, nitrite, nitrous oxide, ammonia, silicate, pH, alkalinity, total carbon dioxide, dissolved hydrogen sulfide, sulfite, thiosulfate, and soluble and particulate iron. On a second cruise, nitrate, nitrite, ammonia, phosphate, and silicate determinations were carried out on a Technicon AutoAnalyzer. Oxygen concentrations in the oxygen-minimum zone were commonly less than 1 microgram-atom/liter from below the pycnocline to depths of several hundred meters. In these nearly anoxic waters, nitrate appears to be reduced to nitrite and free nitrogen. Nitrate deficits, derived from material balance calculations, suggest that up to 13-14 microgram-atoms/liter (40-50 percent) of nitrate-nitrogen have been so reduced. Secondary nitrite concentrations rarely exceed 1.5 microgram-atoms/liter and are generally associated with oxygen concentrations of less than 2 microgram-atoms/liter. Ammonia concentrations appear to be slightly lower in the region of denitrification, probably because of bacterial assimilation. It is estimated that about 230 x 10 to the twelfth power grams of combined N are lost annually by denitrification. (Little-Battelle)

W73-11589

A NEW CRAYFISH OF THE SUBGENUS JUGICAMBARUS FROM TENNESSEE WITH AN EMENDED DEFINITION OF THE SUBGENUS (ASTACIDAE, DECAPODA),
Tennessee Univ., Knoxville. Dept. of Zoology and Entomology.

R. W. Bouchard.

The American Midland Naturalist, Vol 89, No 1, p 103-111, January 1973. 1 fig., 1 tab., 10 ref.

Descriptors: *Crustaceans, *Speciation, *Crayfish, Invertebrates, Tennessee, Ecology, Distribution, Color, Aquatic animals, Life cycles.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

Identifiers: *Jugicambarus*, Macroinvertebrates, Decapods, Arthropods, *Cambarus* (*Jugicambarus*) crinipes, *Cambarus* crinipes.

Cambarus crinipes, a new species of crayfish from the Cumberland Plateau in Tennessee has been described. This new species belongs to the subgenus *Jugicambarus* which has been emended. Color notes, relationships, distribution, life history notes and ecological data are given. A more accurate method of measuring the carapace is proposed and the use of the posterior margin of the epistome as a possible taxonomic structure is introduced. (Holoman-Battelle)

W73-11590

ACUTE AND LONG-TERM ACCUMULATION OF COPPER BY THE BROWN BULLHEAD, *Ictalurus nebulosus*, National Water Quality Lab., Duluth, Minn. For primary bibliographic entry see Field 05C.

W73-11593

BIOLOGICAL EFFECTS OF FLUCTUATING WATER LEVELS IN THE SNAKE RIVER, GRAND TETON NATIONAL PARK, WYOMING, Wyoming Univ., Laramie. Dept. of Zoology and Physiology. For primary bibliographic entry see Field 02E.

W73-11594

PHYSICAL-CHEMICAL OCEANOGRAPHIC DATA FROM THE NORTH PACIFIC OCEAN AND BERING SEA, 1971, National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.

W. J. Graham, Jr., D. M. Fisk, C. J. Bartlett, and S. E. Turner. Available from the National Technical Information Service as COM-73-10192. Data Report 75, February 1973. 172 p, 3 fig, 11 ref.

Descriptors: *Pacific Ocean, *Water temperature, *Depth, *Salinity, *Data processing, Water quality, Computers, Sea water, Density.

Identifiers: *Bering Sea, On board analysis, Sound velocity, RV George B. Keeler.

Temperature and salinity data were obtained in the North Pacific Ocean at 176 stations in 1971 during spring and autumn cruises of the RV George B. Keeler south of the Aleutian Islands, in the Bering Sea, and along the coasts of Washington and British Columbia. Values were obtained from STD traces at standard depths to 1,000m (spring data) or 1,500 m (autumn data). Computations of density (σ_{sigma} -t), sound velocity, anomaly of specific volume, and dynamic height, which were performed by a shipboard PDP-8 computer, are presented. The autumn data tabulations were obtained automatically through a new computer interface. (Little-Battelle)

W73-11595

MEASUREMENT OF EXCHANGEABLE INORGANIC PHOSPHATE IN LAKE SEDIMENTS, Wisconsin Univ., Madison. Water Chemistry Lab. W. C. Li, D. E. Armstrong, and R. F. Harris. Environmental Science and Technology, Vol 7, No 5, p 454-456, May 1973. 2 tab, 22 ref.

Descriptors: *Phosphates, *Lake sediments, *Methodology, *Measurements, *Pollutant identification, Phosphorus, Phosphorus radioisotopes, Aquatic soils, Soil analysis, Chemical analysis, Nutrients, Radioactivity techniques, Sampling, Oxidation, Reduction (Chemical).

Identifiers: *Sediment-water equilibration systems, Lake Mendota (Wis), Lake Wingra (Wis), Lake Crystal (Wis), Lake Little John (Wis), Tomahawk Lake (Wis), Lake Trout (Wis), Devils Lake (Wis), Lake Minocqua (Wis).

The amounts of isotopically exchangeable inorganic phosphate in a range of Wisconsin lake sediments were measured in two contrasting (long- and short term) equilibration systems. The systems differed in equilibration times, oxidation-reduction conditions, and the degree of agitation. Total sediment P was determined by Na₂CO₃ fusion, total organic P by the Mehta extraction procedure, and total inorganic P as the difference between total P and total organic P. Dissolved inorganic P in sediment extracts and in sediment-water equilibration systems was measured by the method of Murphy and Riley (1962). Levels of total exchangeable inorganic P were similar for the two systems, indicating that the simplified short-term equilibration method was suitable for routine measurements of exchangeable inorganic P. Differences between the two systems in the distribution of exchangeable P between the solid and solution phases were apparently related to differences in oxidation-reduction conditions. Exchangeable inorganic P ranged from 18-65 percent of the total inorganic P in the sediments investigated. (Holoman-Battelle)

W73-11596

EFFECT OF CHLORINE ON FLUORESCENT DYES,

California State Dept. of Public Health, Berkeley. Bureau of Sanitary Engineering.

For primary bibliographic entry see Field 05C.

W73-11597

A CYPRINODONTID FISH, *JORDANELLA FLORIDA*, AS A LABORATORY ANIMAL FOR RAPID CHRONIC BIOASSAYS,

National Water Quality Lab., Duluth, Minn.

For primary bibliographic entry see Field 05C.

W73-11598

A COLORIMETRIC TECHNIQUE SUGGESTED FOR CHEMICAL OXYGEN DEMAND DETERMINATION, Jadavpur Univ., Calcutta (India). Dept. of Civil Engineering.

N. Chaudhuri, S. Niyogi, A. De, and A. Basu. Journal Water Pollution Control Federation, Vol 45, No 3, p 537-541, March 1973. 4 fig, 3 tab, 8 ref.

Descriptors: *Chemical oxygen demand, *Methodology, *Colorimetry, *Laboratory tests, Chemical analysis, Waste water (Pollution), Industrial wastes, Domestic wastes, Chemical properties, Organic compounds, Estimating, Carbohydrates, Lipids, Proteins, Organic acids, Alcohols, Amino acids, Correlation analysis, Regression analysis, Volumetric analysis, Water properties.

Identifiers: *Substrates, Data interpretation, Correlation coefficients, Metabolites, Absorbance, Hilger pattern biochemical absorptionmeter, Dextrose monohydrate, Organic solvents, L-glutamic acid, Absorption spectra, n-Butyric acid, Ethyl alcohol, O-Cresol, Alanine, Valine, Acetyl acid, Toluene, Lactose, Sucrose, Tyrosine, Glycine, Lactic acid, Citric acid, Tartaric acid, Maleic acid, Oleic acid, Isopropyl alcohol, Benzene, Catechol, m-Cresol, Salicylic acid, Benzoic acid, Pyridine.

The feasibility and consistency of colorimetric estimation of chemical oxygen demand were investigated using a sufficiently large number of chemicals under varying test conditions. Chemicals representing carbohydrates, fats, proteins, and metabolites that are commonly encountered in domestic and industrial waste water were selected as test substances. A Hilger pattern biochemical absorptionmeter (filter type) was used. The investigation revealed a very high degree of consistency between the colorimetric and chemical oxygen demand values, with a correlation coefficient of 0.99 or above in all tests. The method suggested for use consists of (a) selecting the optimum wave length, (b) determining the colorimet-

ric absorbance on various substrates, and (c) performing a linear regression to calibrate the technique. (Holoman-Battelle)

W73-11599

QUANTITATIVE INFRARED SPECTROPHOTOMETRY OF ORGANIC NITRATE ESTERS,

Picatinny Arsenal, Dover, N.J.

Y. P. Carigan, and C. L. Hickman, IV.

Available from the National Technical Information Service as AD-733938. Technical Report No. PA-TR-4350, May 1972. 71 p, 29 fig, 27 tab, 8 ref.

Descriptors: *Nitrates, Organic compounds, *Nitrogen compounds.

Identifiers: *Nitrate esters, *Infrared spectrophotometry, *Infrared spectra, *Organic nitrogen compounds, Ethyl nitrate, Amyl nitrate, Ethylene glycol dinitrate, Glycerol trinitrate, Celulose nitrate, Absorbance, Organic solvents, Chloroform, Tetrahydrofuran, Quantitative analysis.

A quantitative infrared analysis of the N double bond O asymmetric stretching vibration band for the nitrate esters, ethyl nitrate, amyl nitrate, ethylene glycol dinitrate, glycerol trinitrate, and cellulose nitrate (12.53 percent) is presented. Two solvents, spectrograde chloroform and tetrahydrofuran, were used in the preparation of the solutions. For the five nitrate esters studied, Beer's law for the absorbance of the N double bond O asymmetric stretching band was found to be generally obeyed. From a measure of the absorbance one could calculate the amount of a given nitrate ester present in solution. The band shape for cellulose nitrate was significantly broader and consequently measurement of the absorbance at the band maximum was not a true indication of the absorption intensity. A more realistic measurement would be the integrated intensity of the band. (Holoman-Battelle)

W73-11600

MACROBENTHIC ECOLOGY OF A SAWDUST-BEARING SUBSTRATE IN THE PENOBSCOT RIVER ESTUARY (MAINE), Maine Univ., Orono. Dept. of Zoology.

For primary bibliographic entry see Field 05C.

W73-11602

TRACK ANALYSIS BY ENZYME INHIBITION AND ACTIVATION, Birmingham Univ. (England).

A. Townshend.

Process Biochemistry, Vol 8, No 3, p 22, 24, March 1973. 1 fig, 3 tab, 40 ref.

Descriptors: *Enzymes, *Pollutant identification, *Inhibition, *Chlorinated hydrocarbon pesticides, *Heavy metals, Potassium, Calcium, Magnesium, Manganese, Zinc, Iron, Molybdenum, Copper, Cobalt, Fluorine, Mercury, Iodine, Sulfides, Beryllium, Lead, Aldrin, Heptachlor, DDT, Phosphothioate pesticides, Inhibitors.

Identifiers: *Drugs, Cyanides, Silver, Barium, Indium, Sevin, Lindane, Methyl parathion, Chlordane, Activation, Tetrahydrocannabinol, Morphine sulfate, Sodium phenobarbital, Sensitivity, Sodium barbitone, Detection limits, Alcohol dehydrogenase, Alkaline phosphatase, Lipase, Invertase, Catalase, Hyaluronidase, Isocitrate dehydrogenase, Acid phosphatases, LSD, Hexokinase, Carbonic anhydrase, Phosphatase, Dehydrogenase.

The use of enzyme inhibition and activation to detect metals, nonmetals, pesticides and drugs is reviewed. Activation techniques have been used to detect K, Ca, Mg, Mn, Zn, Fe, Mo, Cu, and Co. Inhibition methods have been used to detect F, Hg, Ag, I, sulfite, cyanide, Ba, Be, Zn, Cu, Fe, In, Rb, the pesticides aldrin, sevin, lindane, heptachlor, and chlordane.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

tachlor, methyl parathion, DDT, and chlordane, and the drugs LSD, tetrahydrocannabinol, morphine sulfate, sodium phenobarbital, and sodium barbitone. Tables are included which show the enzymes used to detect metals, pesticides, and drugs and their detection limits. (Little-Battelle) W73-11604

COPPER DETERMINATION IN WATER BY STANDARD ADDITION POTENTIOMETRY, Missouri Univ., Columbia. Dept. of Chemistry. M. J. Smith, and S. E. Manahan. Analytical Chemistry, Vol 45, No 6, p 836-839, May 1973. 4 fig, 3 tab, 4 ref.

Descriptors: *Copper, *Potable water, *Water analysis, *Methodology, Chemical analysis, Heavy metals.

Identifiers: *Natural waters, *Standard addition potentiometry, *Trace levels, *Cupric ion electrode, Chemical recovery, Ion selective electrode, Copper electrodes, Complexing antioxidant buffer, Reagents.

Potentiometric techniques are described which are applicable to the analysis of tap water and natural waters for very low levels of copper. An Orion Model 94-29A solid-state cupric ion electrode was used in the analysis. Tap water samples were analyzed directly from the tap; natural water samples were first filtered, a complexing antioxidant buffer (CAB) was added, and the potential was allowed to equilibrate. The initial electrode potential and the potentials after each of 3 additions of standard Cu were recorded. The determination of copper in water samples using standard addition techniques with an ion selective electrode was facilitated through the use of CAB. With the method, copper in tap water has been determined at concentrations down to 9 ppb. Copper at a level of 9.0 ppb added to natural water samples containing between 3.3 and 46.8 ppb was analyzed with an average percent recovery of 102.9 percent and a relative standard deviation of 7.5 percent. Reagent purity is a major limiting factor in the analysis, and detailed directions are given for preparing the copper-free reagents required in the analysis. (Holoman-Battelle) W73-11605

DETERMINATION OF NITROGEN, SULFUR, PHOSPHORUS, AND CARBON IN SOLID BIOLOGICAL MATERIALS VIA HYDROGENATION AND ELEMENT SELECTIVE DETECTION, Oak Ridge National Lab., Tenn. A. D. Horton, W. D. Shultz, A. S. Meyer, and D. R. Matthews. Environmental Science and Technology, Vol 7, No 5, p 449-451, May 1973. 1 fig, 4 tab, 4 ref.

Descriptors: *Nitrogen, *Sulfur, *Carbon, *Phosphorus, *Chemical analysis, *Methodology, Aqueous solutions, Hydrogenation, Chemical reactions, Nutrients, Seeds, Leaves, Plant tissues, Insects, Oligochaetes, Sodium sulfate, Copper sulfate.

Identifiers: *Biological materials, *Chemical composition, Sample preparation, Hydrides, Flame photometric gas chromatography, Precision, Electrolytic conductivity gas chromatography, Biological samples, Soil leachate, Millipedes, Spiders, Moths, Cicadas, Sulfuric acid, Phosphoric acid, Sodium nitrate, Potassium dihydrogen phosphate, Pyrolysis.

A rapid method for the simultaneous determination of nitrogen (N), sulfur (S), and carbon (C), and for the separate determination of phosphorus (P), in solid biological field specimens has been developed. No pretreatment of the samples other than freeze- or oven-drying and grinding to less than 40 mesh is required. Samples are weighed into quartz boats and introduced into a Dohrmann pyrolyzer that contains a platinum catalyst

through which hydrogen flows and serves as both reactant and carrier. The elements N, S, P, and C are reduced to their respective hydrides. The effluent from the pyrolyzer is split: one portion passes to a flame photometric detector which responds to H₂S, PH₃, and CH₄; the other portion passes to a Coulomb electrolytic conductivity detector which responds to NH₃. The average coefficient of variation for triplicate determinations of forest floor litter, the most common field specimen, is 1.4 percent for C, 5.8 percent for N, and 5.5 percent for S. Analysis time, exclusive of weighing and purging, is 6-8 minutes per sample with an 8-hr load of 25 samples, including the necessary standards. This system of pyrolysis and catalytic hydrogenation will reduce P, S, N, and C in inorganic compounds also. Water solutions of sodium sulfate, sulfuric acid, phosphoric acid, copper sulfate, sodium nitrate, and potassium dihydrogen phosphate were injected into boats and the water was allowed to evaporate before inserting the boat into the hot zone of the pyrolyzer. The response of the detector to the elements was approximately the same as that for equal amounts of the organically based elements. (Holoman-Battelle) W73-11606

IMPROVED METHOD FOR CHARACTERIZING ENVIRONMENTAL HYDROCARBONS BY GAS CHROMATOGRAPHY, Woods Hole Oceanographic Institution, Mass. O. C. Zafirou.

Analytical Chemistry, Vol 45, No 6, p 952-956, May 1973. 5 fig, 12 tab, 18 ref.

Descriptors: *Methodology, *Pollutant identification, *Water analysis, *Oily water, *Organic compounds, Gas chromatography, Separation techniques, Chemical analysis, Aging (Physical), Water pollution sources, Oil pollution, Variability.

Identifiers: *Flame ionization gas chromatography, *Petroleum products, *Crude oil, *Environmental samples, Precision, Reproducibility, Oil characterization, Sample preparation, Agha Jari crude oil, TI It. crude oil, Oil fingerprinting, No 2 fuel oil, Scot OV-101 columns, Chromatographic columns.

Routinely correlating environmental hydrocarbons from natural waters by gas chromatography requires optimal resolution and separation of weathering resistant components, operational simplicity, and good precision. Methods for comparing results from different columns must precede spectral libraries. A novel method of protecting columns from sample residues involves injecting solutions of oil rich samples into a capillary injection/splitter with disposable glass liner operated at 175°C; reproducible results are obtained without sample cleanup. Temperature programmed OV-101 support-coated open tubular column and FID detection yield excellent characterization. Characteristic signal intensity ratios have long-term relative standard deviations of 1.8-4 percent, 0.7 percent has been achieved short term. Ratios from three columns were similar enough for comparison directly or with a standard. The performance attained is adequate to correlate artificially weathered oils with sources and to differentiate most of thirty oils found in a major port. Extensions and improvements of the method are discussed. (Holoman-Battelle) W73-11607

NEW PICOGRAM DETECTION SYSTEM BASED ON A MASS SPECTROMETER WITH AN EXTERNAL IONIZATION SOURCE AT ATMOSPHERIC PRESSURE, Baylor Coll. of Medicine, Houston, Tex. Inst. for Lipid Research.

E. C. Horning, M. G. Horning, D. I. Carroll, I. Dzidic, and R. N. Stillwell. Analytical Chemistry, Vol 45, No 6, p 936-943, May 1973. 9 fig, 1 tab, 13 ref.

Descriptors: *Pollutant identification, *Urine, Gas chromatography, Mass spectrometry, Digital computers, Laboratory equipment, Calibrations, Instrumentation.

Identifiers: *LC-mass spectrometry, *GC-mass spectrometry, *Detection limits, Cocaine, Methadone, Butabarbital, Pentobarbital, Phenobarbital, Secobarbital, 2,6 dimethyl-alpha-pyrone, Testosterone, Hydroxyphenobarbital, Dihydroxyphenobarbital, Drugs, Biological samples, Metabolites.

A novel mass spectrometer with an external ionization source can be used to detect picogram quantities of compounds of biological interest. The source contains a Ni-63 foil, and is at atmospheric pressure. Samples are introduced in a flowing gas stream in selected common solvents. Positive ions are formed by a complex series of ion molecule reactions. The ionization reaction for the sample may involve either proton transfer or charge transfer. Negative ions are formed by either resonance or dissociative capture of thermal electrons, or by ion-molecule interactions. In a favorable case (very little absorption on the reaction chamber walls), 5-10 picograms could be detected by single ion monitoring, and a scanned mass spectrum could be obtained with as little as 25 picograms. The potential uses include incorporation into LC-MS-COM and GC-MS-COM analytical systems. Cocaine, methadone, butabarbital, pentobarbital, phenobarbital, and secobarbital were analyzed in chloroform solvent, 2,6, dimethyl-alpha-pyrone and testosterone were analyzed in benzene solvent, and phenobarbital, hydroxyphenobarbital, and dihydroxyphenobarbital were analyzed in rat urine extract. (Little-Battelle) W73-11608

GAS CHROMATOGRAPH PEAKS IDENTIFIED ON-LINE BY A NEW GRATING INFRARED SPECTROPHOTOMETER, Norcon Instruments, Inc., South Norwalk, Conn. G. J. Penzias.

Analytical Chemistry, Vol 45, No 6, p 890-895, May 1973. 8 fig, 5 ref.

Descriptors: *Laboratory equipment, *Automation, *Organic compounds, *Pollutant identification, Solvents, Gas chromatography, Instrumentation, Alcohols.

Identifiers: *GC-Infrared spectroscopy, Methyl ethyl ketone, Toluene, n-Butanol, m-Xylene, o-Xylene, Methanol, Isoamyl acetate, p-Tolualdehyde, Aniline, Valeraldehyde, Ethanol, Methyl isobutyl ketone, Ketones, Organic solvents, Polystyrene, Infrared spectrophotometer, Detection limits, Acetone.

A new, double-beam ratio recording grating infrared spectrophotometer that scans from 2.5 to 15 micrometers in 6 seconds has been developed. It is designed to identify eluting gas chromatograph fractions on-line for routine analysis. Heated sample and reference cells are integral with the spectrophotometer, which utilizes a rapid-response, room-temperature detector. The new instrument was used to record infrared spectra of eluting GC fractions of various samples including coatings, paints, polymers, and other organic compounds (polystyrene film, phenolic epoxy solvent, methyl ethyl ketone, ethanol, methyl isobutyl ketone, toluene, n-butanol, m-xylene, o-xylene, acetone, methanol, isoamyl acetate, p-tolualdehyde, aniline, and valeraldehyde). Components of unresolved GC peaks were identified by scanning several spectra during the elution of a single peak. Fractions as small as 0.02 microliter were identified (e.g., a 1 percent component of a 2-microliter sample injected into the gas chromatograph). (Little-Battelle) W73-11609

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

CHEMICAL OXYGEN DEMAND OF SOME NITROGENOUS HETEROCYCLIC COMPOUNDS.
Vysoka Škola Chemicko-Technologicka, Prague (Czechoslovakia). Dept. of Water Technology. J. Chudoba, and J. Dalešický. Water Research, Vol 7, No 5, p 663-668, May 1973. 3 tab, 8 ref.

Descriptors: *Chemical oxygen demand, *Oxidation, *Chemical reactions, Nitrogen compounds, Nitrogen, Organic compounds, Ammonia, Chemical properties, Methodology.

Identifiers: *Heterocyclic hydrocarbons, *Organic nitrogen compounds, Pyridine, Nicotinic acid, Nicotinamide, Quinoline, Pyrrole, L-proline, Indole, D L-Tryptophan, Imidazole, L-histidine, Adenine, Uric acid, Uracil, Riboflavin, Isoalloxazine.

Chemical oxygen demands of fourteen nitrogenous compounds were determined by the dichromate method. Only pyridine and its derivatives were resistant to oxidation. Heterocyclic compounds containing one atom of nitrogen as a molecule, e.g. quinoline, pyrrole, proline, and indole were 90-100 percent oxidized. Nitrogen is split off from these compounds as NH₃. Heterocyclic compounds containing two or more atoms of nitrogen as a molecule are also easily oxidized. However, only a part of the nitrogen is split off as NH₃. On the basis of the results obtained it is possible to make the following generalization: nitrogen in amino groups is split off mostly as NH₃, quinoline, pyrrole, pyrrolidine, and indole nitrogen is split off as NH₃; from imidazole and pyrimidine rings, one atom of nitrogen is split off as NH₃ and one as N₂; from the purine configuration, two atoms of nitrogen are split off as NH₃ and two atoms as N₂; from isoalloxazine, three atoms of nitrogen are split off as NH₃ and one as N₂. (Holoman-Battelle) W73-11611

DISPERSED AND PARTICULATE PETROLEUM RESIDUES IN THE GULF OF ST. LAWRENCE,
Bedford Inst., Dartmouth (Nova Scotia). For primary bibliographic entry see Field 05B. W73-11612

SIMULATED DISTILLATION OF NARROW, HIGH BOILING HYDROCARBON FRACTIONS,
Chevron Research Co., Richmond, Calif. T. H. Gouw.

Analytical Chemistry, Vol 45, No 6, p 987-989, May 1973. 2 fig, 1 tab, 5 ref.

Descriptors: *Distillation, Methodology, Gas chromatography, Chemical analysis, Organic compounds.

Identifiers: *Crude oil, *Graphical techniques, *Boiling point, *Petroleum fractions, Flame ionization gas chromatography, Thermal conductivity gas chromatography, Reproducibility, Petroleum distillation, Southern California crude oil.

A graphical technique has been used to obtain data on the average boiling point and the boiling range of narrow boiling hydrocarbon fractions for characterization purposes. The procedure was carried out in conjunction with a reasonably good gas chromatograph and a device for integrating peak areas. The technique was tested using cuts from the distillation of two Southern California crude oils. Simulated distillation was carried out using 2 Perkin-Elmer GC units equipped with flame ionization detectors and an Aerograph unit equipped with a thermal conductivity detector. Area integration was carried out with an optical integrator or a Disc integrator. The average standard deviations for the three temperatures used were considerably smaller than the deviations obtained by the ASTM simulated distillation method. The

described method does not require equipment as sophisticated as what is necessary for regular simulated distillation. It appears to yield quite precise values for the average boiling point of narrow boiling, high molecular weight hydrocarbon fractions. The method is obviously also applicable to lower molecular weight fractions; in this case, it would probably be more appropriate to carry out a complete component analysis by gas chromatography. The described approach should not be regarded as a replacement or alternative technique to the ASTM D 2887-T method; it should be considered as a complementary method which is very useful in specific applications. (Holoman-Battelle) W73-11613

PESTICIDES IN WATER,
Brigham Young Univ., Provo, Utah. Dept. of Chemistry.
For primary bibliographic entry see Field 05B. W73-11618

GAS CHROMATOGRAPHIC AND MASS SPECTROMETRIC STUDIES OF S-ALKYL DERIVATIVES OF N,N-DIALKYL DITHIOCARBAMATES,
Unisroyal Ltd., Guelph (Ontario), Research Labs. F. I. Omuska, and W. R. Boos. Analytical Chemistry, Vol 45, No 6, p 967-971, May 1973. 5 fig, 2 tab, 8 ref.

Descriptors: *Pollutant identification, Herbicides, Pesticides, Chemical analysis, Separation techniques, Gas chromatography, Mass spectrometry, Organic compounds, Physical properties.

Identifiers: *GC-Mass spectrometry, *S-ethyl N,N-dialkyl dithiocarbamates, *Flame ionization, Gas chromatography, *S-n-propyl N,N-dialkyl dithiocarbamates, Retention time, S-n-propyl N,N-dimethyl dithiocarbamate, Mass spectra, S-n-propyl N,N-diethyl dithiocarbamate, S-n-propyl N,N-di-n-propyl dithiocarbamate, S-n-propyl N,N-di-n-butyl dithiocarbamate, S-methyl N,N-dialkyl dithiocarbamates.

Flame ionization gas chromatography and gas chromatography-mass spectrometry (GC-MS) have been used to separate mixtures by S-alkylated N,N-dialkyl dithiocarbamates. The gas chromatographic retention data are tabulated. A non-polar liquid phase such as Apiezon L was quite suitable for separation. The mass spectral data obtained from the peaks eluted from the gas chromatographic column provided fragmentation patterns of the respective S-methyl DTC, S-ethyl DTC, or S-n-propyl DTC depending on the alkylating agent. These derivatives are easily separated by GC. The electron impact-induced fragmentation of the majority of DTC derivatives is consistent with bond rupture directed by the presence of bivalent sulfur in these molecules. It is very difficult to draw a simple decomposition path using tandem GC-MS because N,N-dialkyl dithiocarbamates are thermally very unstable. (Holoman-Battelle) W73-11622

2,4,6-TRIPHENYL PYRILIUM CHLORIDE. A NEW ORGANIC ANALYTICAL REAGENT FOR THE DETERMINATION OF CERTAIN ANIONS,
Consolidated Foods Corp., Santa Maria, Calif. Union Sugar Div.

T. C. Chadwick. Analytical Chemistry, Vol 45, No 6, p 985-986, May 1973. 2 tab, 21 ref.

Descriptors: *Anions, *Chemical analysis, *Methodology, *Pollutant identification, *Gravimetric analysis, *Synthesis, Hydrogen ion concentration, Chemical precipitation, Chemical reactions, Cations, Zinc, Lead, Cadmium, Gold, Heavy metals, Boron, Sulfates, Fluorides, Bromides, Iron, Halides.

Identifiers: 2,4,6-Triphenylpyrilium, *Reagents, Perchlorates, Boric acid, Accuracy, Experimental error, Ion interference, Chemical interference, Nitron chloride, Tetraphenylarsonium chloride, Tetraphenylphosphonium chloride, Tetraphenylstibonium chloride, Platinum, Tin, Iodates, Chlorates, Oxalates.

A simple synthesis of water-soluble 2,4,6-triphenylpyrilium chloride (TPC) has been devised and a study made of its behavior with a number of anions. Of two gravimetric procedures devised, the one which involves a determination of boric acid by conversion to tetrafluoroboric acid and subsequent precipitation has served to illustrate the utility of the new reagent. TPC. The other procedure involves a direct precipitation of perchlorate ion. TPC was found to give precipitates with iodide, thiocyanate, permanganate, dichromate, and ferrocyanide anions and also with the anionic chloro complexes of Zn (II), Sn (II), Pb (II), Cd (II), Pt (IV), and Au (III). Fluoride, bromide, iodate, chloride, sulfate, and oxalate anions and the chloro complex of iron (III) failed to react with TPC under similar conditions. These experiments show that the reagent behaves very much like nitron and the tetraphenylarsonium, -phosphonium, and -stibonium chlorides. Perchlorate analyses were carried out using only a small (25 percent) excess of reagent to ensure complete precipitation. The precipitate was dried at 110°C without any apparent decomposition. Boron analyses were performed using a modification of the procedure of Lucchesi and DeFord (1957). It was found necessary to use a 60 percent excess of TPC solution to ensure quantitative precipitation. Washing with a saturated, ice-cold, acidified (0.2N HCl) solution of 2,4,6-triphenylpyrilium tetrafluoroborate yielded satisfactory results in all cases. Care must be taken when working with TPC to see that all solutions are acidified because its hydrolysis is fairly rapid above pH 4. (Holoman-Battelle) W73-11623

THE OCCURRENCE AND SEASONAL VARIATION OF TRACE METALS IN THE SCALLOPS PECTEN MAXIMUS (L.) AND CHLAMYX OPERCULARIS (L.),
Marine Biological Association of the United Kingdom, Plymouth (England). Lab. G. W. Bryan.

Journal of the Marine Biological Association of the United Kingdom, Vol 53, No 1, p 145-166, February 1973. 9 fig, 10 tab, 47 ref.

Descriptors: *Bioassay, *Aluminum, *Cadmium, *Chromium, *Cobalt, *Copper, *Iron, *Manganese, *Lead, *Nickel, *Zinc, Mollusks, Heavy metals, Absorption, Season.

Identifiers: *Silver, *Scallops, *Atomic absorption spectrophotometry, Pecten maximus, Samples preparation, Clam opercularis, Biological samples, Macroinvertebrates, Tissue juice, Gonads, Foot, Kidney, Tissue, Preconcentration, Bioaccumulation, English Channel, Body fluids.

Two species of scallops, Pecten maximus (L.) and Chlamys opercularis (L.) were collected over a period of about 3 years from the English Channel in an attempt to follow seasonal changes in trace metal concentrations, to see whether reasons for individual variations could be detected, and to establish baseline concentrations for species from other areas. The body fluid, gonad, foot, kidneys, and remaining tissues from six animals were pooled for analysis of Ag, Cd, Cr, Co, Cu, Fe, Mn, Ni, Pb, and Zn by atomic absorption. Samples were prepared by drying, ashing, dissolving the ash in HCl, evaporating, and adding HCl and distilled water. Since lead, nickel, and cobalt contents were low a concentration procedure was used which involved chelation with ammonium pyrrolidine dithiocarbamate and extraction into methyl isobutyl ketone. Although there was considerable variation between individual animals, the

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

mean concentrations of Ag, Co, Cr, Cu, Mn, Ni, Pb, and Zn were higher in the whole body of chlamyds than Pecten but concentrations of Al, Cd, and Fe were lower. In both species seasonal changes in the concentrations of Co, Cu, Fe, Mn, Ni, Pb, and Zn were observed and in general, the highest values were found in the autumn and winter months. These changes may be related to food supply, since concentrations were generally highest when phytoplankton productivity was low and tended to fall in the spring as productivity increased rapidly to its annual peak. Despite problems arising from individual and seasonal variation, the kidneys and digestive glands of scallops appear to have potential as biological indicators of trace metals. The results obtained for Pecten and Chlamys are compared with those in the literature for species from the family Pectinidae. (Little-Battelle)
W73-11624

THE ACCUMULATION FROM WATER OF ZN-65, MN-54, CO-58, AND FE-59 BY THE MUSSEL, MYTILUS EDULIS,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Radiobiological Lab.

R. J. Pentreath.

Journal of the Marine Biological Association of the United Kingdom, Vol 53, No 1, p 127-143, February 1973. 5 fig, 9 tab, 37 ref.

Descriptors: *Bioassay, *Mussels, *Zinc, *Manganese, *Iron, *Cobalt, Mathematical models, Sea water, Absorption, Radioactivity techniques, Heavy metals, Mollusks, Radioisotopes, Isotope studies, Stable isotopes, Model studies, Radiochemical analysis.

Identifiers: *Bioaccumulation, Zn-65, Mn-54, Fe-59, Co-58, Mytilus edulis, Macroinvertebrates, Biological samples, Foot, Mantle, Gonads, Adductor muscle, Stomach, Digestive gland, Gill, Tissue.

The accumulation from seawater of Zn-65, Mn-54, Fe-59, and Co-58 by the mussel, *Mytilus edulis*, has been studied in relation to the stable element levels of these isotopes both in the sea water and in individual tissues. For all four radionuclides the greatest accumulation occurred in the stomach and digestive gland samples and further localization of Zn-65 and Fe-59 was demonstrated by autoradiography. As the animals were starved during the accumulation period the loss of stable elements by individual tissues was also followed. Again the most notable effect occurred in the digestive gland tissues with the exception of a large loss of iron by the foot. Autoradiography showed that after two weeks accumulation, Fe-59 occurs in large clusters in the foot, notable in the byssus gland area. These clusters disappear after a further two-week period and may thus be secreted into new byssus threads. The accumulation of nuclides was examined using a single exponential model and values obtained for flux rates, biological half times and asymptotic values were compared with the stable element concentration factors. An analysis of parameters of exchange of nuclides in individual tissues with the water was further examined using the Kendall coefficient of concordance. There is an indication that as well as accumulating nuclides via particulate matter in suspension the mucus itself is capable of sequestering them, even though they are in the soluble form, and may even preferentially accumulate soluble forms. The actual role of water in the accumulation of the nuclides studied appears to be relatively minor compared with that of food accumulation as estimated by difference from the calculated stable element values. (Little-Battelle)
W73-11625

APPLICATIONS OF REMOTE SENSING TECHNIQUES TO BUOY-BASED ENVIRONMENTAL DATA GATHERING,
National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

V. E. Derr, C. G. Little, C. B. Emmanuel, F. F. Hall, and P. A. Mandics.

Available from the National Technical Information Service as COM-73-10134. NOAA Technical Memorandum ERL WPL-7, September 1972. 148 p, 18 fig, 11 tab, 59 ref.

Descriptors: *Remote sensing, *Buoys, *Radar, *Meteorological data, *Oceans, *Surface waters, On-site data collections, Air environment, Methodology, Turbulence, Meteoric data, Air temperature, Thermocline, Currents (Water), Mixing, Oceanography, Rainfall intensity, Dissolved Oxygen, Water temperature, Carbon dioxide, Chlorophyll, Aerosols, Sea water, Wind velocity. Identifiers: *Lidar, *Radiometry, *Acoustic echo sounding, Marine environment, Method evaluation, Frequency modulated-continuous wave radar, Microwave radar, Pulsed doppler radar, Incoherent pulsed radar, Pseudorandom coded radar, Random noise radar, Coded radar, Microwave radiometry, Passive infrared radiometry.

The report is in response to a request by the National Data Buoy Project (NDBP) to evaluate possible remote sensing techniques for the interrogation of both the marine atmosphere and the ocean from buoys. The principal optical, radio, and acoustic remote sensing concepts relevant to ocean buoys are identified and discussed. The main body of the report discusses existing remote sensing concepts (acoustic echo sounding, radar, lidar, radiometry, and line-of-sight methods) and makes a preliminary evaluation of their potential applicability to the needs and objectives of the National Data Buoy Project. The environmental difficulties which a system may be expected to experience on the buoy are not treated in depth. Recommendations are presented which are directed toward the efficient exploration and realization of the potentials of the different remote sensing systems. (Holoman-Battelle)
W73-11631

TROPHICAL ROLE OF BACTERIA IN THE ECOSYSTEM OF THE CORAL REEF,
Akademiya Nauk SSSR, Yaroslavl. Institut Biologii Vnutrennykh Vod.

Y. I. Sorokin.
Nature, Vol 242, No 5397, p 415-417, April 6, 1973. 3 fig, 2 tab, 13 ref.

Descriptors: *Biomass, *Bacteria, *Primary productivity, *Reefs, *Trophic level, Food chains, Organic matter, Phytoplankton, Benthic flora, Radioactivity techniques, Coral, Pacific Ocean, Sediments, Marine animals, Oysters, Gastropods, Annelids, Foods, Photosynthesis, Carbon dioxide. Identifiers: Macroinvertebrates, *Pocillopora damicornis*, *Pennaria tiarella*, *Serpulidae*, *Montipora verrucosa*, *Toadocera violacea*, *Ascidia nigra*, *Ophiodesmus spectabilis*, *Nerita picea*, *Crassostrea gigas*, Hydroids, Sponges, Tunicates.

Microbial biomass at several atolls in the Pacific Ocean were determined by direct microscopy on stained membrane filters. Bacteria production and destruction, photosynthesis of phytoplankton and phytopellets, and quantitative values of the feeding of aquatic animals on bacteria were determined using C-14. These results showed that biomass and production of bacteria were in the range of those for eutrophic or mesotrophic lakes. The rate of destruction of organic matter usually exceeded the rate of primary production in the surface layers of water and sediments. Bacteria cells made up 2-5 percent of the total organic matter of the reef sediments. The daily production of raw bacterial biomass in the reef sediments was about 5-15 g/sq m of bottom surface. The high rate of bacterial production may provide a significant part of the food of the fauna of the coral reefs. Experiments were also conducted in which corals were fed with bacterioplankton and seston labelled with C-14. The evolution of labelled metabolic CO₂ by corals was used as a measure of the intensity of feeding

and digestion of labelled bacteria. All the corals tested were able to feed on and digest the bacteria at concentrations close to that in the lagoon. The data show the importance of the bacteria population in the metabolism and productivity of the reef ecosystem. The internal function of the bacteria is nutrient regeneration and production of particulate protein food. The external function may be the consumption and assumption of external energy. (Little-Battelle)
W73-11632

SELECTIVE DETERMINATION OF COPPER (II) IN AQUEOUS MEDIA BY ENHANCEMENT OF FLASH-PHOTOLYTICALLY INITIATED RIBOFLAVIN CHEMILUMINESCENCE,
Tennessee Univ., Knoxville. Dept. of Chemistry. E. L. Wehrly, and A. W. Barnes. Analytical Chemistry, Vol 45, No 6, p 848-851, May 1973. 4 fig, 4 tab, 17 ref.

Descriptors: *Copper, *Aqueous solutions, *Selectivity, *Pollutant identification, Chemical analysis, Heavy metals, Cations, Anions, Alkaline metals, Alkaline earth metals, Methodology, Trace elements, Cobalt, Mercury, Hydrogen ion concentration, Oxygen, Chemical reactions, Photoactivation, Sodium, Calcium, Aluminum, Magnesium, Chromium, Manganese, Iron, Zinc, Nickel, Cadmium, Molybdate, Fluorides, Chlorides, Bromides, Nitrates, Sulfates, Nitrites, Ammonia, Bicarbonates, Water pollution. Identifiers: *Chemiluminescence, *Riboflavin, *Flash photolysis, Detection limits, Organic solvents, Photochemistry, Chemical interference, Sensitivity, Complexing agents, Precision, Buffers, Silver, Ionic interference, Vanadium, Rhodium, Dioxane, Tetrahydrofuran, Acetone, Dimethyl sulfoxide, Acetonitrile, Dimethyl formamide, Methanol, Triethanolamine, Hydrogen peroxide, Perchlorates, Acetates, Sulfites, Cyanides, Thiocyanates, Iodates, Chlorates, EDTA, 1,10-Phanthroline, 8-Hydroxyquinoline, Oxalates.

Copper (II) is determined in aqueous media (pH 6.0) by measuring its enhancement of riboflavin chemiluminescence in systems containing hydrogen peroxide and p-dioxane. The chemiluminescence is initiated by flash photolysis of the reaction system. The light source employed was a microsecond-duration xenon flashtube. Interfering ions are Co (II), Ag (I), Hg (I), and Hg (II); other common metal ions do not significantly interfere. The effects of other experimental parameters (anions, organic solvents, pH, buffer composition, initiating flash energy) are evaluated. The minimum detectable quantity of copper is 30 nanograms. The sensitivity and selectivity of light-and chemically-induced riboflavin chemiluminescence methods are compared; the light-induced system is concluded to be superior. The results suggest that flash photolysis, widely employed in mechanistic photochemistry, also has useful analytical potentialities. (Holoman-Battelle)
W73-11636

A QUANTITATIVE, SEMIROUTINE METHOD FOR DETERMINING ALGAL AND SEDIMENTARY CHLOROPHYLL DERIVATIVES,
Queen's Univ., Kingston (Ontario). Dept. of Biology.

R. J. Daley, C. B. J. Gray, and S. R. Brown. Journal of the Fisheries Research Board of Canada, Vol 30, No 3, p 345-356, March 1973. 4 fig, 6 tab, 44 ref.

Descriptors: *Algae, *Sediments, *Methodology, Separation techniques, Phytoplankton, Aquatic algae, Plant pigments, Marine algae, Plant tissues, Chemical analysis, Chlorophyll, Cyanophyta, Chrysophyta, Solvent extractions, Fluorometry, Chlorophyta, Diatoms, Distillation, Estimating, Spectrophotometry.

Identifiers: *Reverse-phase thin layer chromatography, *Chlorophyll derivatives, Sample prepara-

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants—Group 5A

tion, Sensitivity, Reproducibility, Bacteriochlorophyll a, Pheophytin, Pheophorbide, Chlorophyllide a, Anacystis nidulans, Plectonema boryanum, Pediasium boryanum, Scenedesmus quadricauda, Chlamydomonas reinhardtii, Cyanothece closterium, Nitzschia, Porphyridium, Ochromonas, Lyophilization, Reflectance fluorometry, Ultrasonication.

An integrated quantitative method is described for the determination of chlorophylls and chlorophyll degradation products in freshwater phytoplankton and sediments. Prior to extraction, algal samples were concentrated by filtration through glass fiber filters while sediment samples were lyophilized. All materials were extracted in a mixture of acetone, methanol, and water (80:15:5) by ultrasonication in a glass extraction chamber refrigerated at -10°C. Extracts were filtered through solvent-resistant membrane filters, rather than centrifuged, and then fractionated without prior drying by reverse-phase thin-layer chromatography on oil-impregnated layers of kieselguhr G. Using three chromatographic systems consisting of different developing solvents and oil phases (triolein, paraffin oil, and castor oil), rapid, artefact-free separations of chlorophylls a, b, and c and 18 of their derivatives were obtained. Individual pigments were estimated by direct, in situ thin-layer scanning with a filter fluorometer. The sensitivity and reproducibility of the procedure are ca. 2 ng and 11 percent, respectively. In routine operation, the method is fast and relatively simple, a complete analysis being accomplished in 1.5 hr. (Holoman-Battelle)

W73-11637

IDENTIFICATION OF THE CONSTITUENTS OF KRAFT PULPING EFFLUENT THAT ARE TOXIC TO JUVENILE COHO SALMON (ONCORHYNCHUS KISUTCH).

British Columbia Research Council, Vancouver.

J. M. Leach, and A. N. Thakore.

Journal of the Fisheries Research Board of Canada, Vol 30, No 4, p 479-484, April 1973. 3 fig., 16 ref.

Descriptors: *Pollutant identification, *Effluents, *Pulp wastes, *Toxicity, *Juvenile fish, Chemical analysis, Salmon, Biassay, Douglas fir trees, Hemlock trees, Distillation, Organic compounds, Methodology, Fibers (Plant), Industrial wastes, Gas chromatography, Organic acids, Separation techniques.

Identifiers: *Oncorhynchus kisutch, *Chemical composition, *Fatty acids, *Resin acid soaps, Flame ionization gas chromatography, Unbleached whitewater, GC-Mass spectrometry, Sample preparation, Thin layer chromatography, Sodium isopimarate, Sodium abietate, Sodium dehydroabietate, Palmitoleic acid, Oleic acid, Linoleic acid, Methyl isopimarate, Methyl abietate, Lauric acid, Myristic acid, Palmitic acid, Stearic acid, Arachidic acid, Behenic acid.

The nonvolatile constituents that are acutely toxic to juvenile coho salmon (*Oncorhynchus kisutch*) have been fully identified in a kraft pulping effluent derived from Douglas fir and western hemlock. Toxicity and material balances were maintained throughout a fractionation procedure leading to isolation of the toxic factors. Fractions were monitored by flame ionization gas chromatography and thin-layer chromatography. Individual compounds were identified initially by combination GC-mass spectrometry. Over 80 percent of the toxicity was caused by three resin acid soaps: sodium isopimarate (55 percent), sodium abietate (22 percent), and sodium dehydroabietate (5 percent). The remaining toxicity (18 percent) was contributed by sodium salts of the unsaturated fatty acids: palmitoleic, oleic, linoleic, and linolenic. (Holoman-Battelle)

W73-11638

PLANKTONIC CHANGES FOLLOWING THE RESTORATION OF LAKE TRUMEN, SWEDEN, Lund Univ. (Sweden). Limnology Inst. For primary bibliographic entry see Field 05G. W73-11639

2,3-DIHYDROXYNAPHTHALENE AS INDICATOR FOR THE COMPLEXOMETRIC TITRATION OF IRON (III) WITH EDTA, Hans Raj Coll. Delhi (India).

G. S. Manku.

Zeitschrift fur Analytische Chemie, Vol 263, No 4, p 335, March 6, 1973.

Descriptors: *Heavy metals, *Iron, *Chelation, *Methodology, Cations, Volumetric analysis, Chemical analysis, Anions, Alkaline earth metals, Strontium, Chemical reactions, Pollutant identification, Bromides, Fluorides, Zinc, Cadmium, Calcium, Strontium, Manganese, Magnesium, Beryllium, Aluminum, Titanium, Phosphates, Iodides, Halides, Nickel, Copper.

Identifiers: *2-Dihydroxynaphthalene, *Complexometric titration, *EDTA, *Chemical indicators, Chemical interference, Complexation, Metal chelates, Borates, Tartrates, Citrates, Barium, Antimony, Bismuth, Zirconium, Thiosulfates, Cyanides, Vanadium, Oxalates, Sulfocyanides, Vanadates, Molybdates, Tungstates, Uranyl.

2,3-Dihydroxynaphthalene has been used as a metal indicator for the complexometric titration of Fe (III) with EDTA. The pH of the acidic Fe (III) solution (0.1-67 mg) was adjusted to about 2 with ammonia, and 1 M HCl-sodium acetate buffer (pH 5) and 0.5 percent w/v ethanolic 2,3-dihydroxynaphthalene were then added. The resulting solution was diluted with distilled water and titrated against a 0.010-0.050 M EDTA solution until a sharp color change from purple to colorless was observed. The relative standard deviation for the procedure was 0.8-1.5 percent. Cyanide, sulfocyanide, oxalate, Ni (II), V (IV), Vanadate, Molybdate, tungstate, uranyl and Cu (II) ions were found to seriously interfere with the procedure. No interference was caused by these ions: bromide, borate, tartrate, citrate, fluoride, Zn, Cd, Ca, Ba, Sr, Mn (II), Mg, and Be. Given amounts of the following ions could be tolerated in relation to a known quantity of Fe (III): Al, Sb, Bi, Co, Zr, Ti, phosphate, thiosulfate, and iodide. (Holoman-Battelle)

W73-11641

A SOLVENT EXTRACTION METHOD FOR THE DETERMINATION OF PHOSPHORUS-32 IN SEA WATER.

Australian Atomic Energy Commission Research Establishment, Lucas Heights.

W. W. Flynn, and W. R. Meehan.

Analytica Chimica Acta, Vol 63, No 2, p 483-488, February 1973. 5 tab, 7 ref.

Descriptors: *Sea water, *Separation techniques, Water analysis, *Phosphorus, Radioactivity techniques, Aluminum, Aqueous solutions, Water, Calcium, Cobalt, Chromium, Copper, Iron, Mercury, Magnesium, Manganese, Nickel, Lead, Zinc, Nitrates, Sulfates, Molybdenum, Sodium, Radioisotopes, Nuclear reactors, Radioactive wastes.

Identifiers: *Scintillation counting, *P-32, *Chemical recovery, *Chemical interference, Sample preparation, Storage, Ac-228, As-76, Ba-133, Bi-207, Ca-45, Ce-144, Co-60, I-131, Mn-54, Mo-99, Na-22, Silver, Arsenic, Bismuth, Cesium, Fluorine, Iodine, Lanthanum, Columbium, Rubidium, Antimony, Silicon, Strontium, Tin, Tellurium, Thorium, Uranium, Yttrium, Zirconium, Acetates, Ascorbic acid, Borates, Oxalates, Tartric acid, Barium, Actinium, Cerium.

Seawater samples to be analyzed for Phosphorus-32 were collected in polyethylene bottles and treated with perchloric acid. The perchloric acid

treatment converts all phosphorus to orthophosphate. The procedure involved adding a phosphorus carrier (potassium dihydrogenphosphate), and extracting P-32 as the phosphomolybdate from a solution of 0.66 M sulfuric acid with isobutyl acetate. A buffered ammonium solution stripped the carrier from the solvent and a precipitate (as magnesium ammonium phosphate) was used for counting. This method was unsatisfactory with demineralized water, but substitution of isoamyl alcohol gave 90-95 percent recovery of the carrier from solutions as high as 0.7 N in acid. Results were similar with seawater. Recoveries of phosphorus ranged from 16 percent to 100.8 percent. Addition of interfering ions Ag, Al, As, Bi, Ca, Co, Cr (3 plus), Cs, Cu (2 plus), Fe (3 plus), F, Hg, I, La, Mg, Mn, Nb, Ni, Pb, Rb, Sb, Si, Sr, Sn, Te, Th, U, Y, Zn, Zr, acetate, ascorbic acid, borate, citrate, nitrate, oxalate, sulfate, and tauric acid did not affect recovery. Study of radionuclides (Ac-228, As-76, Ba-133, Bi-207, Ca-45, Ce-144, Co-60, I-131, Mn-54, Mo-99, and Na-22) showed decontamination factors in excess of 1000 for most. The recovery of P-32 from samples of seawater spiked with standard solutions and stored for six weeks in polyethylene bottles under various conditions showed that the method was quantitative. (Little-Battelle)

W73-11643

MULTI-ELEMENT NEUTRON ACTIVATION ANALYSIS OF SEDIMENT USING A CALIFORNIA-252 SOURCE,

Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

D. W. Hayes, and S. F. Peterson.

Available from the National Technical Information Service as DP-MS-72-38, Report September 11, 1972. 4 p, 4 fig, 2 tab, 2 ref. Contract No. AEC-AT (07-2)-1.

Descriptors: *Bottom sediments, *Cores, *Neutron activation analysis, *Radioactivity techniques, *Chemical analysis, Heavy metals, Alkaline earth metals, Halogens, Pollutant identification, Aquatic soils, Atlantic Ocean, Soil analysis, Manganese, Aluminum, Calcium, Sodium, Chlorine, Magnesium, Titanium, Bromine, Oceans, Irradiation.

Identifiers: *Multielemental analysis, *California-252, Rare earth elements, Vanadium, Dysprosium, Californium radioisotopes.

The application of a Cf-252 source to the neutron activation analysis of several elements in small (approximately 1.5 inch in diameter) cores was studied using high-resolution gamma ray spectroscopy and manual data reduction. A preliminary study of 4-inch segments of various ocean bottom cores by this method showed that Mn, Al, Ca, Na, Cl, and V were easily detected. Other elements found in some of the samples were Mg, Ti, Br, Dy, Ca, and I. Cores from the Atlantic Ocean were analyzed for the easily detectable elements, and on the basis of elemental content, were characterized as pelagic clay or pure sand. With a few modifications, the procedure could be used aboard a ship or on shore to obtain rapid elemental analysis of sediment cores using a Cf-252 source, Ge (Li) detector, multichannel analyzer, and manual data reduction. The procedure could also be used to analyze sediment cores from estuaries or tidal flats. The procedure could be improved by using a 4096 analyzer, and computerized data reduction, and by rotating the core during activation and counting. Procedures are discussed for eliminating interference and differences in irradiation and counting between standards and samples. (Holoman-Battelle)

W73-11644

INFLUENCE OF LEAD AND OTHER METALS ON FISH DELTA-AMINOEVULINATE DEHYDRASE ACTIVITY,

National Marine Water Quality Lab., West Kingston, R. I.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

E. Jackim.
Journal of the Fisheries Research Board of Canada, Vol 30, No 4, p 560-562, April 1973. 1 fig, 1 tab, 6 ref.

Descriptors: *Bioassay, *Inhibition, *Heavy metals, *Enzymes, Copper, Cadmium, Lead, Zinc, Silver, Toxicity, Marine fish.
Identifiers: *Sample preparation, *Mummichogs, *Winter flounder, Aminolevulinate acid dehydrase, Biological samples, Fundulus heteroclitus, Pseudopleuronectes americanus.

Mummichogs (*Fundulus heteroclitus*) and winter flounder (*Pseudopleuronectes americanus*) were exposed to solutions of Cu, Cd, Pb, Zn, and Ag salts for periods of 96 hours and 2 weeks to study the effects of lead and other metals on delta-aminolevulinate acid dehydrase activity (ALA-D). ALA-D activity was determined by homogenizing the organs in KCl, adding phosphate buffer and ALA-D. After one hour, reactions were stopped by the addition of HgCO₂ and trichloroacetic acid. This solution was centrifuged, the supernatant treated with Ehrlich's reagent and glacial acetic acid and allowed to react, and optical density determined as a measure of enzyme activity. Lead decreased ALA-D activity in both acute and chronic exposures in fish. The inhibition was not unique to lead, but appears to be limited to a few toxic heavy metals, namely lead, mercury, and copper. Other metals (zinc, silver, and cadmium) increased enzyme activity at least during early periods of exposure or low concentrations. The results of the tests are expected to provide an index of response to heavy metals in estuarine waters. (Little-Battelle)
W73-11646

A CENTRIFUGE METHOD FOR DETERMINING LIVE WEIGHTS OF AQUATIC INSECT LARVAE, WITH A NOTE ON WEIGHT LOSS IN PRESERVATIVE,
Colorado State Univ., Fort Collins. Dept. of Zoology.

J. A. Stanford.
Ecology, Vol 54, No 2, p 449-451, Early Spring 1973. 4 fig, 5 ref.

Descriptors: *Aquatic insects, *Larvae, *Methodology, Larval growth stage, Weight, Diptera, Caddisflies, Stoneflies.
Identifiers: *Weight loss, *Live weights, *Sample preservation, Reproducibility, Data interpretation, *Pteronarcys californica*, *Hydropsyche occidentalis*, *Brachycentrus*, *Atherix variegata*, Ethyl alcohol.

A reproducible centrifuge drying method for determining live or preserved weights of aquatic insects is described. Live or preserved larvae are transferred into centrifuge tubes with forceps, or they may be filtered from the preservative by pouring the sample through a tube. The tubes are inserted into the shields of the centrifuge head; the larvae are spun for 3 min at 650 rpm. Weights are computed by subtracting the weight of the empty centrifuge tube from the weight of the tube plus insects after spinning. Care must be taken, however, to keep water from the outside of the tube since it does not spin off. An attempt was made to derive a conversion factor for weight loss in preservative. Results showed a great interspecific variation in weight loss over a period of time due to the effect of preservative. (Holoman-Battelle)
W73-11647

THE HEAVY METAL CONTENT OF RAINFALL IN THE EAST MIDLANDS,
Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Soils.
E. G. Hallsworth, and W. A. Adams.
Environmental Pollution, Vol 4, No 3, p 231-235, April 1973. 2 tab, 2 ref.

Descriptors: *Heavy metals, *Rainfall, *Chemical analysis, *Water analysis, *Air pollution effects, *Fly ash, *Pollutant identification, Water pollution, Fog, Colorimetry, Copper, Cobalt, Lead, Molybdenum, Calcium, Aluminum, Magnesium, Titanium, Iron, Manganese, Chromium, Nickel, Zinc, Boron.
Identifiers: Optical spectroscopy, Vanadium, Silicon.

Analyses of rainfall were made between March 1973 and March 1964 to determine whether irregularities in the growth of clover plants at the University of Nottingham were due to contamination by fly-ash from power stations in the area. In order to test this, a series of small polyethylene funnels were set up and the rainwater was collected in polyethylene bottles which were emptied at monthly intervals or more frequently depending upon rainfall intensity. The rainwater was washed out of the bottles with distilled water, evaporated to dryness, the weight of dry matter obtained, and ashed before analysis. Cu and Co were determined colorimetrically, and other constituents by optical spectroscopy. The disparity recorded between rainfall and contamination and the apparent dependence of the latter on seasonal factors, such as fog, suggested that the major contribution to the input was not airborne soil. The differing heavy metal content of the fly-ash and rainfall ash from the various sources was discussed, the copper and molybdenum content being considerably higher at certain sites than at others. An unusually high level of lead was noted. (Holoman-Battelle)
W73-11648

SMALL-SCALE EXPERIMENTS TO DETERMINE THE EFFECTS OF CRUDE OIL FILMS ON GAS EXCHANGE OVER THE CORAL BACK-REEF AT HERON ISLAND,
For primary bibliographic entry see Field 05C.
W73-11650

SUBLETHAL EFFECTS OF BALTIMORE HARBOR WATER ON THE WHITE PERCH, MORONE AMERICANA, AND THE HOGCHOKER, TRINECTES MACULATUS,
Maryland Univ., Solomons. Natural Resources Inst.
For primary bibliographic entry see Field 05C.
W73-11652

A SIMPLE MICROSCALE VACUUM COLLECTOR FOR THE ELUTION OF CLOSELY SITUATED SPOTS FROM THIN-LAYER CHROMATOGRAMS,
Fisheries Research Board of Canada, West Vancouver (British Columbia), Vancouver Lab.
J. Y. Cheng.
Journal of the Fisheries Research Board of Canada, Vol 30, No 3, p 460-461, March 1973. 1 fig, 1 tab, 8 ref.

Descriptors: *Reliability, Laboratory equipment, Plant pigments, Laboratory tests, Marine algae, Separation techniques, Sampling.
Identifiers: *Thin layer chromatography, *Microscale vacuum collector, *Elution, Chemical recovery, Chlorophyll a, Chlorophyll c, alpha-Carotene, Canthaxanthin, Diatoxanthin, Fucoxanthin, Peridinin, Lutein, Seaxanthin, Chroomonas salina, Isochrysis galbana, Cryptomonads.

A 'homemade' device, utilizing disposable Pasteur pipettes and a side-armed test tube, is described for convenient quantitative removal and elution of closely separated spots from thin-layer chromatograms. Its simplicity of manipulation and 'disposability' after use offer an excellent economic and timesaving elution technique for routine handling of numerous samples. (Holoman-Battelle)
W73-11657

A COMPARISON OF BENTHIC MICROALGAL PRODUCTION MEASURED BY C-14 AND OXYGEN METHODS,
Copenhagen Univ., Hillerod (Denmark). Freshwater Biological Lab.

C. Hunding, and B. T. Hargrave.
Journal of the Fisheries Research Board of Canada, Vol 30, No 2, p 309-312, February 1973. 1 tab, 15 ref.

Descriptors: *Primary productivity, *Radioactivity techniques, *Benthic flora, *Algae, *Carbon, *Absorption, *Dissolved oxygen, Photosynthesis, Methodology.

Identifiers: Sensitivity, C-14, Errors.

A comparison of estimates of benthic primary production on a sandy beach measured by in situ oxygen and laboratory C-14 methods showed that both methods gave similar measures of the magnitude of production. Sources of error in each method are discussed. Measures of C-14 uptake offer sensitivity when production is low, but when undisturbed sediment cores can be obtained, production is most easily measured by following changes in dissolved oxygen. (Little-Battelle)
W73-11658

AN IMPROVED EKMAN-TYPE GRAB,
Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.

W. Burton, and J. F. Flanagan.
Journal of the Fisheries Research Board of Canada, Vol 30, No 2, p 287-290, February 1973. 2 fig, 1 tab, 4 ref.

Descriptors: *Sampling, *Design, *Reliability, Mechanical equipment, Benthos, Statistical methods.

Identifiers: *Grab sampler, *Ekman grab sampler.

An improved Ekman-type grab with top lids, which are locked open during descent and weighted to keep them closed during retrieval, is described. In comparative trials with a Wildco Tall 6-inch Birge-Ekman, the new grab collected significantly more chironomids and oligochaetes, and about the same number of the heavier and larger animals such as gastropods, sphaeriids, trichopterans, etc. The new design also improves the versatility and mechanical reliability of the grab. (Little-Battelle)
W73-11659

SAMPLING PROCEDURES AND PROBLEMS IN DETERMINING PESTICIDE RESIDUES IN THE HYDROLOGIC ENVIRONMENT,
Geological Survey, Arlington, Va.

H. R. Feltz, and J. K. Culbertson.
Pesticides Monitoring Journal, Vol 6, No 3, p 171-178, December 1972. 8 fig, 1 tab, 18 ref.

Descriptors: *Aquatic environment, *Pesticide residues, *Methodology, *Equipment, *Sampling, Pollutant identification, Water sampling, Fluvial sediments, Data collections, Bottom sediments, DDT, DDE, DDD, Chlorinated hydrocarbon pesticides, Monitoring, Variability.

Identifiers: Data interpretation, Sample preservation, Depth-integrating sampler, Suspended-sediment samplers, Bed-material sampler, Sampling frequency.

Diligent use of standardized sampling and analytical techniques is essential to meaningful assessments of the occurrence, distribution and fate of pesticide residues in the hydrologic environment. The validity of analytical data and subsequent interpretations are interdependent and limited to the confidence level of adequate, representative sampling of various components. Equally important are appropriate sample-preservation practices and procedures for sample preparation and cleanup and identification, measurement, and confirmation of residues. Analytical schedules should include pesticides listed in the Revised Chemicals

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

Monitoring Guide for the National Pesticide Monitoring Program and should be responsive to special interests. Samplers are available for collecting acceptable water, fluvial material, and bottom-material samples in about 75 percent of the river miles and in lakes and estuaries throughout the United States; however, more experience is needed in sampling hydrosols and low intensity deposits at the active water-sediment interface. (Holoman-Battelle)
W73-11660

BOD: DETERMINING THE NECESSARY DILUTION TECHNIQUE,
Uniroyal, Inc., Naugatuck, Conn. Pollution Abatement Control.
J. A. Brown, Jr., J. Paul, L. C. Rice, and J. M. Lines.
Water and Sewage Works, Vol 120, No 5, p 105, May 1973. 4 ref.

Descriptors: *Methodology, *Biochemical oxygen demand, *Mathematical studies, *Measurements, Water quality, Water pollution effects, Equations, Chemical oxygen demand.
Identifiers: *Dilution technique, Sample size, Accuracy.

A method is presented whereby the dilutions necessary for the BOD test are calculated mathematically with the virtual elimination of trial and error methods outlined in 'Standard Methods'. With the simple calculations presented and by utilizing a few logical assumptions, the BOD sample size can be adequately calculated. In the Industrial Pollution Abatement Laboratory which performs BOD's at a rate of about 1200 a year this method has been an improvement over the trial and error method of determining dilution volumes. The number of tests that have to be repeated because of improper dilution has been greatly reduced. (Holoman-Battelle)
W73-11661

POLAROGRAPHIC METHOD FOR NITRATE AND DISSOLVED OXYGEN ANALYSES,
Saskatchewan Univ., Saskatoon. Dept. of Civil Engineering.
C. P. Hwang, and C. R. Forsberg.
Water and Sewage Works, Vol 120, No 4, p 71-74, April 1973. 1 fig, 4 tab, 5 ref.

Descriptors: *Nitrates, *Dissolved oxygen, *Polarographic analysis, *Methodology, *Pollutant identification, Chemical analysis, Water analysis, Industrial wastes, Waste water (Pollution).
Identifiers: Phenoldisulfonic method, Iodometric method, Accuracy, Precision.

A polarographic apparatus with a rapid dropping electrode was investigated as a potentially better method to determine nitrate and dissolved oxygen. Nitrate was found to produce well-defined waves of d-c curves in region of -1.25 v, however, the recommended measurement of nitrate is at -1.40 v. It takes only seven minutes (five minutes for deaerating, one minute for reading, and one minute for using the calibration curve) compared to five hours for the phenoldisulfonic acid method. The precision of the polarography method and the phenoldisulfonic acid method is plus or minus 0.27 mg/l and plus or minus 0.22 mg/l. Results using the polarograph method and the azide modification of the iodometric method in the determination of dissolved oxygen in BOD tests show that the polarographic method mostly yields the higher values. The azide modification requires 30 minutes to get results, the polarographic method requires only 2 minutes and, in contrast, can measure DO in the range found in water, wastewater, and industrial wastes. This method is not subject to the usual interferences; its precision in 0.1 N KCl solution is plus or minus 0.075 mg/l. (Holoman-Battelle)
W73-11662

IMPROVED DOUBLE DETECTION GAS CHROMATOGRAPH-MASS SPECTROMETER INTERFACE FOR THE ANALYSIS OF COMPLEX ORGANIC MIXTURES,
Rome Univ. (Italy). Istituto di Chimica Analitica.
F. Bruner, P. Ciccioli, and S. Zelli.
Analytical Chemistry, Vol 45, No 6, p 1002-1006, May 1973. 5 fig, 1 tab, 5 ref.

Descriptors: *Organic compounds, *Instrumentation, Chemical analysis, Laboratory equipment, Research equipment, Gas chromatography, Mass spectrometry.

Identifiers: *GC-Mass spectrometry, *Mixtures.

The results are reported that were obtained by modifying an AEI MS 12 mass spectrometer for better gas chromatography - mass spectrometry operation. The changes introduced in the gas lines have been the following: Elimination of every metal part except the three-way connection at the end of the column, and substitution of the metal capillary with a glass rod (0.5-mm i.d., 5-mm o.d.) to connect the column to the separator. The part of the chromatograph usually employed for the inlet splitter of capillary columns injection is used to make the connection with the mass spectrometer. In this way the injection port, FID, and the first part of the line connecting the GC to the MS are placed very close to each other and heated at the same temperature using the original heating system given by the manufacturer. With the modified apparatus, it is possible to eliminate the Total Ion Monitor (TIM) recording of the chromatogram using for this scope FID trace. By working with the repetitive scanning device operating continuously during the chromatogram and watching the output of the mass spectrometer on an oscilloscope, one has only to check the intensity of the spectrum, and when it reaches the right value, push the button to record the spectrum of a given chromatographic peak on the UV light oscillograph to get it displayed on paper. The results show also that many defects of coupling MS and GC, attributed to the separator, are actually dependent on the inefficiency of the gas lines of the interface. (Holoman-Battelle)
W73-11663

LIQUID-LIQUID EXTRACTION OF CADMIUM WITH HIGH-MOLECULAR-WEIGHT AMINES FROM IODIDE SOLUTIONS,
Oak Ridge National Lab., Tenn.

C. W. McDonald, and F. L. Moore.
Analytical Chemistry, Vol 45, No 6, p 983-985, May 1973. 5 tab, 7 ref.

Descriptors: *Separation techniques, *Mercury, *Cadmium, *Aqueous solutions, Radioactivity techniques, Heavy metals, Hydrogen ion concentration, Solvent extractions.

Identifiers: *Amines, Chemical recovery, Stripping, Cadmium iodide, Primene JM-T, Primene 81-R, Amberlite LA-1, Alamine 336-S, Aliquat 336-S.

The extraction behavior of cadmium from acidic and alkaline aqueous iodide solutions was studied using four classes of high-molecular-weight amines. The amines investigated were Primene JM-T, Primene 81-R, Amberlite LA-1 (N-dodecyltriethylammonium), Alamine 336-S (tricaprylamine), and Aliquat 336-S (tricaprylmethylammonium chloride). These were dissolved in xylene and converted to iodide salts. Preliminary tests were conducted with aqueous solutions containing Cd-109 labelled cadmium chloride. With acid solutions, all amines except Primene JM-T extracted quantitatively. With alkaline solutions, only Aliquat 336-S extracted quantitatively with Primene 81-R showing very high extractability. Aliquat 336-S, therefore, was used in additional studies to determine the effect of pH, HI concentration, and concentration of extractant on cadmium extraction. Ammonium hydroxide, 5 percent ethylenediamine, and 0.1 M cysteine-1 M sodium hydroxide, each proved to be excellent extractants

of cadmium from the Aliquat 336-S-I-xylene solutions. Further studies with solutions containing cadmium and mercury and extracted with Aliquat 336-S-I-xylene showed that the mercury and cadmium could be separated by stripping the cadmium with ammonium hydroxide or ethylenediamine and then stripping the mercury with alkaline cysteine. (Little-Battelle)
W73-11664

5B. Sources of Pollution

DIRECT DETERMINATION OF THE ELECTROMAGNETIC REFLECTION PROPERTIES OF SMOOTH BRACKISH WATER TO THE CONTINUOUS SPECTRUM FROM 100 MILLION TO 4 BILLION HERTZ,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 021.
W73-11052

POLLUTION AS A RESULT OF FISH CULTURAL ACTIVITIES,
Utah State Div. of Wildlife Resources, Salt Lake City.

R. N. Hinshaw.
Copy available from GPO Sup Doc as EPI.23:73-009, \$2.60; microfiche from NTIS as PB-221 376, \$0.95. Environmental Protection Agency, Ecological Research Series Report EPA-R3-73-009, February 1973. 209 p, 5 fig, 1 tab, 13 ref. EPA Project 18050 EDH.

Descriptors: Water pollution, *Fish hatcheries, Fish, Water quality, Public health, Fish management, Water quality standards, Outfall, Water pollution sources, *Benthic fauna.

Identifiers: *Trout hatchery, Pollution evaluation, Receiving waters, *Fish cultural activities, Water quality criteria, *Fish hatchery discharges.

Fish hatchery activities have been suspected as a source of pollution. This study was undertaken to evaluate hatchery discharges in relationship to possible pollution. A program of semi-monthly physical-chemical analysis was conducted for a year at six trout hatcheries. These determinations were taken at the hatchery inflow and outfall, the receiving water above and below the hatchery outfall. Bottom fauna was sampled once a month during the summer and bi-monthly through the winter on selected stations in the receiving waters. Flow data was recorded for the influent, effluent, and receiving waters. There was no correlation between the pounds of food fed in the hatcheries and: (1) changes of chemical quality in the receiving waters; (2) changes in kinds and numbers of bottom fauna organisms in the receiving waters. The analysis of samples revealed degradation of the water quality through every hatchery and in the receiving water. This degradation was beneficial from a fisheries standpoint but water quality and public health considerations may require cleanup before acceptable levels could be achieved. (EPA)
W73-11077

STATE-OF-THE-ART REVIEW OF PULP AND PAPER WASTE TREATMENT,
Wapors, Inc., Washington, D.C.
For primary bibliographic entry see Field 05D.
W73-11080

AN INVENTORY OF SUSPENDED SEDIMENT STATIONS AND TYPE OF DATA ANALYSIS FOR PENNSYLVANIA STREAMS, 1947-70,
Geological Survey, Harrisburg, Pa. Water Resources Div.
For primary bibliographic entry see Field 022.
W73-11083

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

TRITIUM CONCENTRATION OF A VARIETY OF WATER SAMPLES: FIFTH LISTING,
Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Soils.

M. W. Hughes, and J. C. Dighton.
Available from NTIS, Springfield, Va. 22151 NP-1939. Price \$3.00 printed copy; 95 cents microfiche. Technical Memorandum No 4, 1972. 6 p, 8 tab.

Descriptors: *Tritium, *Water pollution sources, *Chemical analysis, *Surface waters, *Groundwater, Data collections, Rain water, Pastures, Forests, Australia, Radioisotopes, Path of Pollutants.

This memorandum presents a further listing of tritium concentrations determined by the method described by Hughes and Holmes in C.S.I.R.O., Division of Soils, Technical Paper 3, 1970. These samples were analyzed during the period 2/22/71 to 8/25/71 and the 133 samples reported brings the total of tritium analyses in this laboratory to 628. All results have an estimated standard deviation of 7% or 0.3 T.U. whichever is the larger. The tables of data include: tritium concentration of Hawthorn (Adelaide) rainfall; rain water samples from Cape Northumberland (South Australia); samples taken from the top of the water table at a selection of pasture and forest sites in the southeast of South Australia; samples taken from beneath the water table from installed tubes at Padthaway and Mt. Gambier; tritium concentration of water obtained by burning wheat and wine samples in oxygen; tritium concentration of a variety of underground water samples from the southeast of South Australia; tritium concentration of a variety of surface samples from the southeast of South Australia; and tritium content of a subsurface water sample from Tasmania. (Woodard-USGS)

W73-11104

NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY : APPENDIX H, MINERALS.
Bureau of Mines, Washington, D.C.
For primary bibliographic entry see Field 03D.
W73-11107

CHARACTERISTICS AND ENVIRONMENTAL QUALITY OF SIX NORTH SHORE BAYS, NASSAU AND SUFFOLK COUNTIES, LONG ISLAND, NEW YORK,
State Univ. of New York, Stony Brook. Marine Science Research Center.
For primary bibliographic entry see Field 02K.
W73-11108

SURVEY OF WATER QUALITY AND SEDIMENTS IN SIX NORTH SHORE BAYS, NASSAU AND SUFFOLK COUNTIES, LONG ISLAND, NEW YORK (APPENDIX TO TECHNICAL REPORT NO. 14),
State Univ. of New York, Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 02K.
W73-11109

LEAF PROCESSING IN A WOODLAND TROUT STREAM,
Michigan State Univ., Hickory Corners. W.K. Kellogg Biological Station.
R. C. Petersen, K. W. Cummins, and F. O. Howard.
Report TD-COO-2002-14, 1972. 36 p, 4 fig, 10 tab, 45 ref. AEC Contract AT (11-1-2002).

Descriptors: *Decomposing organic matter, *Leaves, *Leaching, *Surface waters, Degradation (Decomposition), Systematics, Laboratory tests, On-site investigations, Streams, Testing procedures, Evaluation, Correlation analysis, Classification, Water pollution sources.
Identifiers: Leaf decay rate, Decay coefficients.

The 24-hour leaching experiments of leaf material in streams and subsequent daily monitoring for additional effects, show that the dominant leaching effect is within the first 24 hours. Using techniques of Riggs (1970) a log-normal plot of leaf decay shows two distinct decay functions with a decided break at 24 hours. This result appears in the natural stream or in laboratory experiments using glass beakers to conduct the leaching. Comparing a 6-day experiment with measurements every day, with data for up to 143 days, does not show any additional severe break. The calculated leaching decay coefficients are presented for the seven main species along with the percentage lost per day. The leaching coefficient is expressed on a daily basis as are all the decay coefficients. (Woodard-USGS)

W73-11112

WATER QUALITY INVESTIGATIONS: SOURIS RIVER BASIN, NORTH DAKOTA, 1969.
Environmental Protection Agency, Kansas City, Mo. Region VII.

B. Hegg.

Available from NTIS, Springfield, Va. 22151 as PB-214 072, Price \$3.00 printed copy; \$0.95 microfiche. Report, February 1971. 65 p, 5 fig, 23 tab, 10 ref, app.

Descriptors: *Water quality, *Chemical analysis, *Water analysis, *Streams, *North Dakota, Water properties, Nutrients, Water pollution sources, Physical properties, International waters, Canada, International law, Municipal wastes, Industrial wastes, River basins, Water pollution effects.
Identifiers: *Souris River basin (N. Dak.).

A water quality investigation was carried out during the summer and fall of 1969 to provide information on basic water quality conditions in the Souris River basin, North Dakota, and to define sources of water quality degradation. Physical, chemical, bacteriological, and biological parameters were evaluated at a number of locations throughout the United States portion of the basin. Water quality conditions reflected a river system which was basically eutrophic. Nutrient concentrations, especially phosphorus, were adequate to support intense algal blooms. Water quality was degraded by untreated municipal waste discharges at the North Dakota communities of Kemnare, Velva, and Tower and by the industrial waste discharge from Winger Cheese Company at Tower. All of these waste dischargers presently provide secondary treatment. Other sources of nutrients, oxygen-demanding materials, and other pollutants which degrade water quality were found in runoff from unused land, agricultural runoff including animal feedlot drainage, irrigation return flows, urban runoff, decaying vegetation in shallow impoundments, and large flocks of migrating waterfowl. The distribution and use of Souris River water is controlled by various water rights and several international agreements. Water supply is inadequate to provide for all desired uses, and conflicts exist over priority of water use. (Woodard-USGS)

W73-11115

PHOSPHATE IN INTERSTITIAL WATERS OF ANOXIC SEDIMENTS: OXIDATION EFFECTS DURING SAMPLING PROCEDURE,
John Hopkins Univ., Baltimore, Md. Dept. of Earth and Planetary Sciences.

J. T. Bray, O. P. Bricker, and B. N. Troup. Science, Vol 180, No 4093, p 1362-1364, June 29, 1973. 2 fig, 14 ref. AEC Contract AT (11-1)-3292.

Descriptors: *Phosphates, *Bottom sediments, *Chesapeake Bay, *Pore water, Water pollution sources, Oxidation, Sampling, Iron, Eutrophication, Path of pollutants.

Oxidation during sampling procedures significantly decreases the inorganic phosphate concentrations of interstitial water rich in iron (II). All

sampling and analytical procedures must be carried out in an inert atmosphere. Orthophosphate in interstitial water of sediments, in equilibrium with vivianite, may be a nutrient source for the overlying water. This is a potential cause of eutrophication in Chesapeake Bay. (Knapp-USGS)
W73-11118

ECOLOGY OF YELLOWSTONE THERMAL EF-FLUENT SYSTEMS: INTERSECTS OF BLUE-GREEN ALGAE, GRAZING FLIES (PARACOENIA, EPHYDRIDA) AND WATER MITES (PARTNUIELIA, HYDRACHNELLAE),
Georgia Univ., Athens. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W73-11113

BIOLOGICAL OXIDATION OF THE HYDROCARBONS IN AQUEOUS PHASE,
Department of the Environment, Burlington (Ontario). Centre for Inland Waters.

D. L. Liu, and B. J. Dutka.

Journal Water Pollution Control Federation, Vol 45, No 2, p 232-239, February 1973. 12 fig, 1 tab, 9 ref.

Descriptors: *Microbial degradation, *Oil wastes, *Oxidation, *Gas chromatography, Pseudomonas, Oil water, Enzymes, Oxygen demand, Waste treatment.

Identifiers: *Pseudomonas desmolytica, *Decane, Culture media, Metabolites, Biological oxidation, Sample preparation.

Biological oxidation of hydrocarbons in aqueous phase by Pseudomonas desmolytica was studied by manometric and gas chromatographic techniques. The organisms were grown on media containing n-decane and Indulin C in a cyclone fermenter for 20 hours before the harvesting of the cells. Cell-free extracts were prepared by centrifugation and chemical treatment. Overall oxygen consumption as determined in a differential respirometer was taken as a measure of enzyme activity. Oxidation products were identified using a chromatograph equipped for flame ionization detection. Cell free extracts prepared from cells grown on n-decane plus the thiolignin Indulin-C were more active in oxidation of n-decane than were corresponding cells grown on n-decane alone. The hydrocarbon-oxidizing enzyme was most active at pH 7 and could be precipitated by 30 percent ammonium sulfate. Manometric and gas chromatographic studies indicated that the initial oxidate attack occurred at the terminal methyl carbon and required both oxygen and nicotinamide adenine dinucleotide. These studies suggest that Indulin-C or other nontoxic surfactant may be used to accelerate biological treatment of petroleum waste water. (Little-Battelle)
W73-11122

WATER QUALITY MODELS FOR TOTAL COLIFORM,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.

R. P. Canale, R. L. Patterson, J. J. Gannon, and W. F. Powers.

Journal Water Pollution Control Federation, Vol 45, No 2, p 325-335, February 1973. 10 fig, 10 ref.

Descriptors: *Coliforms, *Water quality, Model studies, *Turbidity, *Temporal distribution, Environmental effects, Seasonal, Water temperature, Kinetics, Enteric bacteria, Mathematical models, Michigan, Least squares method, Water pollution sources, Water pollution, Beaches, Lakes, Ecological distribution, *Lake Michigan, Mortality, Statistical models.

Identifiers: *Grand Traverse Bay, Survival, Boardman River, Species density, Autoregression, Deterministic models.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

First-order kinetic formulations approximated the death curve of total coliform bacteria following an initial growth period in experiments where domestic waste water was added to Lake Michigan water. Three separate studies using water collected during different seasons have demonstrated that the first-order rate coefficient is temperature dependent and relatively independent of illumination, prechlorination, and season of the year. The rate coefficient exhibits a linear variation with temperature. The seasonal changes in total coliform density in the bay, as measured at the Traverse City municipal water intake, can be approximated using weighted sine and cosine series, auto-regression, and multiple-regression statistical models. Although it is possible to obtain a satisfactory fit of the data with each of these approaches, such models cannot be reliably used for long-range predictions. Historical data collected in Grand Traverse Bay demonstrate regular seasonal variations as well as long-range trends for total coliform density and turbidity. Additional data convey a consistent spatial pattern of total coliform at beaches in near-shore regions of the bay. These data and data from more recent surveys along with circulation patterns predicted from modeling studies suggest that a deterministic approach based on continuity equations may be possible. (Holoman-Battelle)
W73-11135

OXIDATION OF COPPER (II) SELENIDE BY THIOBACILLUS FERROOXIDANS,
Department of Natural Resources, Quebec.
Mineral Research Center.
For primary bibliographic entry see Field 05C.
W73-11171

ORGANIC MATERIALS IN THE MARINE ENVIRONMENT AND THE ASSOCIATED METALLIC ELEMENTS,
Bhabha Atomic Research Centre, Bombay (India).
T.N.V. Pillai, M. V. M. Desai, E. Mathew, S. Ganapathy, and A. K. Ganguly.
Current Science, Vol 40, No 4, p 75-81, Feb 20, 1971. 1 fig, 8 tab, 25 ref.

Descriptors: *Trace elements, *Sea water, *Solvability, *Organic matter, Chemistry, Analytical techniques, Chemical analysis, Sediments, Distribution, Zinc, Manganese, Cobalt, Cesium, Potassium, Calcium, Strontium, Aluminum, Iron, Copper, Barium, Sorption, Marine algae, Marine geology.

Dissolved organic matter obtained from an algal culture grown in a marine medium was found to solubilize trace elements. The rate at which the solubilized elements change their ionic properties with the growth of the culture and the relative abundance of cationic, anionic, and non-ionic species of these elements were studied at elemental concentrations up to 500 micrograms/liter. The sorption of Zn, Mn, and Co by a sample of coastal marine sediment was observed to be many times higher than by the same sediment freed of organic matter, whereas sorption of alkali and alkaline earth elements such as Cs, K, Ca, and Sr showed no significant difference. Trace element analysis showed that humic materials showed high contents of trivalent elements such as Al and Fe, and of bivalent elements such as Cu and Zn. Studies on the interaction of humic acid with added solutions of trace elements show that alkali and alkaline earth elements, such as Sr, Ba, Ra, exist in exchangeable cationic; transition elements, such as Zn, Mn, Cu, and Co, exist in cationic and non-cationic; while trivalent heavy elements exist mostly in non-cationic forms in the humic acid. (Jerome-Vanderbilt)
W73-11184

METABOLISM OF TRITIATED WATER IN THE DAIRY COW,
California Univ., Livermore. Lawrence Livermore Lab.
G. D. Potter, G. M. Vattone, and D. R. McIntyre.
Health Phys. Vol 22, No 4, p 405-409, 1972. Illus.
Identifiers: *Cows (Dairy), Meat, *Metabolism, Milk, Nuclear technology, *Tritiated water, Radionuclides.

The transfer of manmade radionuclides through the cow-milk and cow-meat-man pathways was studied. In view of the fact that tritium is a by-product of reactors, nuclear testing, natural gas stimulation by nuclear explosives and other nuclear technologies, it is of interest to study the metabolism of this nuclide in the form of tritiated water in the dairy cow following oral administration. The present work includes the study of organically bound tritium as well as unbound tritiated water in the milk, blood, urine and feces of the Holstein dairy cow.—Copyright 1973, Biological Abstracts, Inc.
W73-11186

PHENYLMERCURIC ACETATE: METABOLIC CONVERSION BY MICROORGANISMS,
Wisconsin Univ., Madison. Dept. of Entomology.
F. Matsumura, Y. Gotoh, and G. M. Boush.
Science, Vol 173, No 3991, p 49-51, 2 July 1971. 3 fig, 11 ref.

Descriptors: *Chromatographic analysis, *Radiochemical analysis, *Mercury, *Organic compounds, *Microorganisms, Biochemistry, Water pollution, Soil pollution, Laboratory tests, Inorganic compounds, Distribution, Metabolism, Aquatic animals.

The extent to which mercury-containing compounds contribute to the formation of methylmercury derivatives, which are known to cause neurological damage, is discussed. An attempt was made in laboratory tests to study the metabolic fate of phenylmercuric acetate in soil and aquatic organisms, and to investigate the significance of the action of microorganisms on the fate of mercury residues. Labelled 203 Hg phenylmercuric acetate was used in analysis of the distribution of radioactivity between the supernatant and the sediment after incubation in a culture medium. The major portion of the mercury residue in the supernatant was bound to organic matter present in either the soluble protein fraction or the amino acid fraction. Almost all of the mercury residues in the microbial incubation products exist either as a form bound to organic matter or as a solvent-extractable organic mercury compound. The amount of inorganic mercury produced is likely to be extremely small. One of the major metabolic products was diphenylmercury. In none of the cases has a methylmercury derivative been found among the microbial metabolic products of phenylmercuric acetate. (Jerome - Vanderbilt)
W73-11187

COMPOSITION OF AIRBORNE LEAD PARTICLES,
Ethyl Corp. Research Labs., Ferndale, Mich.
For primary bibliographic entry see Field 05A.
W73-11188

GEOLOGY AND GROUND-WATER CHARACTERISTICS OF THE HANFORD RESERVATION OF THE U.S. ATOMIC ENERGY COMMISSION, WASHINGTON,
Geological Survey, Washington, D.C.
R. C. Newcomb, J. R. Strand, and F. J. Frank.
Geological Survey Professional Paper 717, 1972. 78 p, 11 fig, 3 plate, 3 tab, 50 ref.

Descriptors: *Nuclear powerplants, *Radioactive waste disposal, *Water pollution effects, *Hydrogeology, *Water quality, Environmental

effects, Groundwater, Aquifers, Surface waters, Geochemistry, Geology, Water wells, Water level fluctuations, Hydrologic data, Artificial recharge. Identifiers: *U.S. Atomic Energy Commission, *Hanford Reservation (Wash).

Investigations were made to obtain general information on the geologic and hydrologic situations that control many of the operations on the Hanford Reservation of the Atomic Energy Commission. Important aspects were the conditions that govern disposal of radioactive waste to the geologic environment, the general geologic conditions at the plant site, and the availability of groundwater for various industrial and domestic water supplies. The work consisted of geologic mapping of the reservation, determining the composition and interrelations of the stratigraphic units, and deriving the characteristics of the groundwater. After the start of the work in 1950, a second project, involving mostly drilling and sampling work around disposal sites, was undertaken and carried on after the completion of the original project in 1953. The drilling was continued until 1958; some of the data obtained in that work are included. Disposal of radioactive materials beneath the low terraces along the Columbia River has created some potential hazards, should the river become diverted and cut new channels through such disposal sites. (Woodard-USGS)
W73-11204

EFFECT OF SOIL, COVER, SLOPE, AND RAINFALL FACTORS ON SOIL AND PHOSPHORUS MOVEMENT UNDER SIMULATED RAINFALL CONDITIONS,
Ohio State Univ., Columbus. Dept. of Agronomy.
D. A. Munn, E. O. McLean, A. Ramirez, and J. Logan.
Soil Science Society of America Proceedings, Vol 37, No 3, p 428-431, May-June 1973. 1 fig, 7 tab, 14 ref.

Descriptors: *Leaching, *Soil erosion, *Phosphates, *Nutrient removal, Phosphorus, Infiltration, Percolation, Runoff, Rainfall intensity, Water chemistry, Soil chemistry, Eutrophication.

Removal of phosphorus was studied in three soils treated with phosphorus at 25, 125, and 625 micrograms per gram of soil in bare and cropped microplots and subjected to simulated rainfall. The quantity of runoff water, eroded solids, and P in the runoff increased with degree of slope and rainfall intensity. A high correlation ($r=0.997$) was found between total P in the runoff from the bare plots and the quantity of soil eroded. Concentrations of soluble P in runoff from the plots was sufficient to eutrophy emulated water. The soil was nearly saturated with water and the system was closed so that runoff and leachate from a given rain were inversely related. Hence, the plant cover which was very effective in reducing runoff volume and soil erosion (as well as P losses) increased the quantity of percolating water. The increased percolation of water increased the P leached from cropped plots having uniformly mixed P. Dominant P fractions and their increases with rate of P application were directly related to extractable Fe and Al content, pH, and percentage base saturation of the original soils. There was no significant change in the amount of P in organic form with rate of P application. (Knapp-USGS)
W73-11208

PHOSPHORUS LOSSES FROM FOUR AGRICULTURAL WATERSHEDS ON MISSOURI VALLEY LOESS,
Agricultural Research Service, Lincoln, Nebr. North Central Region.
G. E. Schuman, R. G. Spomer, and R. F. Piest.
Soil Science Society of America Proceedings, Vol 37, No 3, p 424-427, May-June 1973. 6 tab, 15 ref.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

Descriptors: *Phosphates, *Soil erosion, *Water pollution sources, *Path of pollutants, Adsorption, Sediment yield, Sheet erosion, Suspended load, Erosion control, Loess, *Iowa.

Phosphorus losses from four field-size experimental watersheds at Treynor, Iowa, were measured during 1969-71. A contour-planted corn watershed and a pasture watershed were fertilized at the recommended P rate (39 kg/ha). A level-terraced and a second contour-planted corn watershed were fertilized at 2.5 times this rate. At the high level of P fertilization, phosphorus loss by surface runoff from the contour-planted corn watershed was 0.493 kg/ha in 1969, 1.034 kg/ha in 1970, and 2.130 kg/ha in 1971. Level terraces greatly reduced P loss by reducing runoff and erosion. Water samples for all runoff events taken above the overfall of each watershed gully contained considerably more inorganic P in solution than samples taken at the weir site, 70 to 230 m downstream. This reduction in solution P was caused by the adsorption of P by the additional suspended soil material entering the stream from gully erosion. (Knapp-USGS) W73-11209

SIMULTANEOUS TRANSPORT OF CHLORIDE AND WATER DURING INFILTRATION,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02K.
W73-11213

INDUSTRIAL WASTE SURVEY, DADE COUNTY, FLORIDA.
Federal Water Quality Administration, Fort Lauderdale, Fla. Lower Florida Estuary Study.

Available from NTIS, Springfield, Va. 22151 as PB-213 299, Price \$3.00 printed copy; \$0.95 in microfiche. Environmental Protection Agency, Athens, Georgia. Southeast Water Laboratory Technical Report TS03-71-208-03.1, September 1971. 76 p, 10 fig, 5 tab, 5 append.

Descriptors: *Water pollution sources, *Industrial wastes, *Surface waters, *Florida, Sampling, Water analysis, Chemical analysis, Water pollution control, Biochemical oxygen demand, Chemical wastes, Pulp wastes, Canneries, Flood processing industry, Thermal pollution, Oil wastes, Coliforms, Toxins.
Identifiers: *Dade County (Fla).

Studies of industrial pollution of surface waters in Dade County, Florida, reveal that: (1) twenty-one industries discharge to groundwater by various means and 15 discharge to surface waters; (2) industrial wastes are contaminating the inland waters of Dade County by the addition of oxygen demanding materials, petroleum derivatives, coliform bacteria and toxic substances; (3) industries sampled contribute over half of the BOD load discharged into inland Dade County waters; (4) many industries discharge cooling waters mixed with process waste waters; (5) to meet treatment requirements established by the Dade County Board of Commissioners, pretreatment will be required at most industries; (6) in-plant changes, recycling, and improved housekeeping techniques would substantially reduce waste discharges at many industries; (7) inadequately disinfected discharges from 11 food processing and paper mill industries present a health hazard; and (8) of the 15 industries discharging to surface waters, those discharging to navigable waters are in violation of the 1899 Refuse Act. (Woodard-USGS)
W73-11217

LITHIUM IN SURFICIAL MATERIALS OF THE CONTERMINOUS UNITED STATES AND PARTIAL DATA ON CADMIUM,
Geological Survey, Washington, D.C.
H. T. Shackleford, J. G. Boernagen, J. P. Cahill, and R. L. Rahill.

Circular 673, Washington, D.C., 1973. 8 p, 2 fig, 2 tab, 20 ref.

Descriptors: *Metals, *Cadmium, *Soils, *Analytical techniques, *Geochemistry, Chemical analysis, Geologic surveys, Statistical methods, Distribution patterns, United States, Pollutant identification.

Identifiers: *Lithium, *Surficial materials, Atomic absorption spectroscopy.

Concentrations of lithium in 912 samples of soils and other regoliths from sites approximately 50 miles apart throughout the United States are represented on a map by symbols showing the five ranges of values. A histogram of the lithium concentration is also given. The geometric mean lithium concentration is 20.4 ppm (parts per million) for all samples, 17.3 ppm for samples from the Eastern United States, and 23.3 ppm for samples from the Western United States. Cadmium concentrations were less than 1 ppm in all but 11 of the 912 samples. Ten of these 11 samples contained from 1 to 1.5 ppm cadmium; one sample contained 10 ppm cadmium. (Oleszkiewicz-Vanderbilt) W73-11268

THE LEAD INDUSTRY AS A SOURCE OF TRACE METALS IN THE ENVIRONMENT,
Missouri Univ., Rolla. Dept. of Civil Engineering; and Missouri Univ., Rolla. Environmental Health Research Center.

B. G. Wixson, E. Bolter, N. L. Gale, J. C. Jennett, and K. Purushothaman.

Paper presented at the Environmental Resources Conference on Cycling and Control of Metals, BaHelle Memorial Institute, Columbus, Ohio, October 31-November 2, 1972. 22 p, 7 fig, 16 ref.

Descriptors: *Mining, *Industrial wastes, *Heavy metals, *Missouri, Trace elements, Zinc, Copper, Cadmium, Effluents, Dusts, Fallout, Air pollution, Water pollution, Bacteria, Algae, Sampling, Streams, Vegetation, Evaluation, Environmental effects.
Identifiers: *Mining wastes.

Mining, milling, transportation and smelting of lead ore in the Viburnum Trend area of Southeast Missouri are discussed with emphasis placed on pollution introduced into the environment during each of these processes. During the mining and milling processes it is possible for lead and other trace metals to enter the environment from mine water, from dust particles resulting from the grinding process and from the tailing dams at settling ponds. Lead concentrations exceeded 0.1 ppm 42 times during a year-long survey of stream water.

The benthic flora associated with nutrient trapping and recycling were seen as excellent filters for ore particles. Along transportation routes elevated levels of trace elements were found up to 100 feet from the roadway. Open trucks and railroad cars contribute to wind-blown trace metals in the environment. Smelting operations introduce lead, zinc, copper and cadmium particulate matter into the air. Areas around smelting plants were monitored and fallout decreased with increased distance from the stack. (See also W73-11270) (Jerome-Vanderbilt)
W73-11269

AN INVESTIGATION OF ENVIRONMENTAL POLLUTION BY LEAD AND OTHER HEAVY METALS FROM INDUSTRIAL DEVELOPMENT IN SOUTHEASTERN MISSOURI,
Missouri Univ., Rolla. Dept. of Civil Engineering; and Missouri Univ., Rolla. Environmental Health Research Center.

B. G. Wixson, and W. H. Tranter.

Paper presented at the 1972 National Telecommunications Conference, Houston, Texas, December 4-6, 1972. 5 p, 1 fig, 11 ref.

Descriptors: *Wastes, *Mining, *Heavy metals, *Lead, *Remote sensing, Engineering, Environ-

mental engineering, Air pollution, Soil contamination, Water pollution, Copper, Cadmium, Zinc, Path of pollutants, Data collection, Evaluation, Sampling, Instrumentation, Vegetation, *Missouri.

Air, soil, and water investigations of environmental pollution are underway in the New Lead Belt of Southeast Missouri. Planned future investigations are discussed with emphasis on applications of remote sensing to monitor the environment. Mining and smelting operation wastes contain the trace elements lead, copper, zinc, cadmium and other metals which may be harmful to the ecosystem. Preliminary results indicate that the air environment is the primary medium through which particulates containing lead and other trace metals reach various receptors in soil, plants and water. These particulates do not carry far from the source. Soil samples from the New Lead Belt area were found to have higher metal concentrations than background levels, and these concentrations were greater near smelting facilities and along roadways and railroads. Dissolved concentrations found in streams in the area were relatively low. Remote sensing by photographic techniques allows data collection over a large area with relative ease. The primary remote sensing tool has been color and infrared photography. Soil and vegetation seem to be the primary sinks for heavy metals in the ecosystem. (See also W73-11269) (Jerome-Vanderbilt)
W73-11270

ENVIRONMENTAL IMPACT OF TRACE METALS ON THE NEW LEAD BELT OF S.E. MISSOURI,
Missouri Univ., Rolla. Dept. of Civil Engineering; and Missouri Univ., Rolla. Environmental Health Research Center.
For primary bibliographic entry see Field 05C.
W73-11271

TRANSFER OF METALLIC MERCURY INTO THE FOETUS,
Rochester Univ. Medical Center, N.Y.
M. R. Greenwood, T. W. Clarkson, and L. Magos. Experientia, Vol 28, No 10, p 1455-1456, 1972. 1 tab, 3 ref.

Descriptors: *Mercury, *Animal pathology, *Laboratory tests, Metals, Heavy metals, Pathology, Blood, Path of pollutants, Toxicity.
Identifiers: *Foetus, Clinical studies, Rats.

Wistar rats were exposed to radioactive mercury vapor for 2 1/2 minutes, another group of animals was exposed to labelled mercuric chloride through i.v. injection. The data demonstrate that the amount of mercury in the blood was over 25 times greater in animals injected with ionic mercury than in vapor exposed rats. This difference is probably due to the fact that metallic mercury rapidly diffuses from blood to tissues as reported previously. Despite this difference in blood levels the total amount of mercury taken up by the placental-foetal unit was approximately the same. However, in animals exposed to the radioactive vapor nearly half of the mercury taken up by the placental-foetal unit was found in the foetus compared with 1% in the group injected with inorganic Hg. (Oleszkiewicz - Vanderbilt)
W73-11274

LEAD CONTAMINATION OF SNOW,
Ministry of the Environment, Ottawa (Ontario). Water Management.
N. LaBarre, J. B. Milne, and B. G. Oliver. Water Research, Vol 7, 1973. 4 p, 1 tab, 21 ref.

Descriptors: *Lead, *Snow, *Air pollution, *Water pollution, Gasoline, Sediments, Precipitation, Runoff, Surface waters, Analytical techniques, Sampling, Heavy metals, Path of pollutants.

Sources of Pollution—Group 5B

Identifiers: Automobile exhaust, Leaded gasoline.

Snow from disposal sites and along roads contained considerable lead due to the combustion of leaded gasolines by automobiles. In spite of lead concentrations up to 4330 ppm in the sample particulate, the highest concentration in samples melted and filtered through Whatman No. 1 filter paper was 0.21 ppm with the average, 0.04 ppm. Thus, the dumping of snow away from watercourses instead of directly into them significantly reduces lead contamination of the waters from this source. (Oleszkiewicz-Vanderbilt)
W73-11275

DIURNAL VARIATION OF AEROSOL TRACE ELEMENT CONCENTRATIONS IN LIVERMORE, CALIFORNIA,
California Univ., Livermore. Lawrence Radiation Lab.
K. Rahn, J. J. Wesolowski, W. John, and H. R. Ralston.
Journal of the Air Pollution Control Association, Vol 21, No 7, p 406-409, July 1971. 1 fig, 1 tab, 6 ref.

Descriptors: *Trace elements, *Metals, *Distribution patterns, *Aerosols, *California, Air pollution, Mercury, Cadmium, Nickel, Lead, Alkali metals, Heavy metals, Sampling, Neutron activation analysis, Path of pollutants, Pollutant identification.

Identifiers: Antimony, Bismuth, Air samples.

Concentrations of 15 atmospheric aerosol trace elements in Livermore, California, were measured by neutron activation analysis in 2-hour filter samples for 58 hours during 3 typical summer days. All elements showed cyclic patterns with concentration variations of factors of 3 to 10. Three basic patterns were seen: (1) Na and Cl in phase with each other and nearly perfectly out of phase with the others, with a late night maximum for both; (2) All other elements except Br, showing a midafternoon maximum; and (3) Br, which had morning and evening peaks suggestive of automotive sources. Details of the patterns suggest a diurnal circulation model for the Livermore Valley involving alternation between fresh and aged marine air. Comparison of the trace element patterns with those of CO, NO₂, and 'oxidant' was not definitive. (Oleszkiewicz-Vanderbilt)
W73-11277

AREAWIDE TRACE METAL CONCENTRATIONS MEASURED BY MULTIELEMENT NEUTRON ACTIVATION ANALYSIS - A ONE DAY STUDY IN NORTHWEST INDIANA,
Michigan State Univ., East Lansing. Dept. of Meteorology and Oceanography.
P. R. Harrison, K. A. Rahn, R. Dams, J. A. Robbins, and J. W. Winchester.
Journal of the Air Pollution Control Association, Vol 21, No 9, p 563-570, September 1971. 4 fig, 6 tab, 19 ref.

Descriptors: *Trace elements, *Metals, *Neutron activation analysis, Distribution patterns, *Indiana, Air pollution, Sampling, Heavy metals, Alkali metals, Water pollution, Hazards, Mercury, Lead, Cadmium, Statistical methods, Path of pollutants.
Identifiers: *Air samples.

A suite of 24 hour high volume air particulate samples, collected June 11-12, 1969, at 25 locations in the Northwest Indiana area, has been analyzed by non-destructive neutron activation analysis for 30 trace elements. Ge (Li) gamma-ray spectrometry, computer assisted data reduction and replicate analysis have been used in the study. Some elements, such as Na, K, Ti, Al, Sm, and Eu, show only minor concentration variations over the area, while others, such as Cu, W, Cr, Zn, Sb, Ga, Br, Ag, Fe, and Ce, show large variations, indicative of important local sources. Similar distribution patterns and high correlation coefficients suggest

common sources for several elements. The variations of most heavy elements significantly exceed previously reported variations of total particulate, indicating the latter to be an unsatisfactory guide for elemental distribution, especially near pollution sources. Three representative locations for measurement of elemental abundances in the area are suggested. The influence of meteorological conditions and the potential Lake Michigan pollution hazard are discussed. (Oleszkiewicz-Vanderbilt)
W73-11278

ARSENIC, CADMIUM, COPPER, MERCURY, AND ZINC IN SOME SPECIES OF NORTH ATLANTIC FINFISH,

Skidaway Inst. of Oceanography, Savannah, Ga.
H. Windom, R. Stickney, R. Smith, D. White, and F. Taylor.
Journal of the Fisheries Research Board of Canada, Vol 30, No 2, p 275-279, 1973. 1 fig, 3 tab, 6 ref.

Descriptors: *Mercury, *Zinc, *Cadmium, *Copper, Fish, Seawater, Distribution, Public health, Food drains, Food pyramids, Animal pathology, Trace elements, Atlantic Ocean, Analysis, Analytical techniques, Instrumentation, Sampling, Testing, Pollutant identification, Water pollution, Toxicity.

Identifiers: *Arsenic, *North Atlantic, Concentration, Sensitivity, *Finfish.

Arsenic, cadmium, copper, mercury, and zinc analyses of 91 individuals representing 35 species of North Atlantic finfish (Chondrichthys and Osteichthys) indicate that these metals occur at similar levels in both inshore and offshore species. Chondrichthys and Osteichthys have similar concentrations of all the metals, excepting arsenic which is higher in Chondrichthys. Analyses of various tissues in Chondrichthys reveal higher metal concentrations in the liver except for mercury which is higher in muscles. (Oleszkiewicz-Vanderbilt)
W73-11279

HEAVY METALS: FALLOUT AROUND A POWER PLANT,
Hope Coll., Holland, Mich. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W73-11282

STUDIES ON THE SOURCES OF POLLUTION IN DAIRY WATER: I. PROPERTIES OF THE WASTE WATER FROM POTATO STARCH FACTORIES (IN JAPANESE),

Obihiro Zootechnical Univ. (Japan). Dept. of Veterinary and Public Health.

M. Takahashi, and T. Nishi.
Res Bull Obihiro Zootech Univ Ser I. Vol 7, No 1, p 53-52, 1971. Illus. English summary.

Identifiers: *Dairy water, Factories, Pollution, *Potato-D starch, Waste water, Water pollution sources.

A survey was made of the discharged wastes from 5 potato starch factories in the Tokachi district from 1968-1969. The waste water qualities in the starch manufacturing process and in the waste treating process was investigated particularly in 1 factory. Turbidity, pH, transparency, total solids, dissolved solids, suspended solids, dissolved O₂, BOD, COD and potassium permanganate consumed (PPC) were determined by standard methods of sewage analysis. The averages of discharging wastes in 5 factories were BOD: 90-625 ppm; COD: 96-211 ppm; PPC: 196-481 ppm. The characteristic qualities in discharged wastes depended largely on the manufacturing process and facilities of the 5 potato starch factories and on the waste treatment. Characteristic qualities in the various starch wastes determined in the starch manufacturing process and in the waste treating

process were as follows: BOD value in decanter juice was 23,000 ppm; decanter wastes 18,000 ppm; first separator wastes 22,000 ppm; second separator wastes 710 ppm. COD values were proportionate to BOD results. However, in flume wastes BOD and COD values were low, but turbidity was 850 ppm and suspended solids of 280 ppm were relatively high. Various improvements in waste treatment which were established included jet aeration equipment, protein salvage equipment, and total material salvage equipment for decanter juice. The potato starch wastes, if untreated, possibly pollute stream and ground (drinking, dairy and fishing) water.—Copyright 1972, Biological Abstracts, Inc.

W73-11284

VOLATILIZATION OF MERCURIC CHLORIDE BY MERCURY-RESISTANT PLASMID-BEARING STRAINS OF *ESCHERICHIA COLI*, *STAPHYLOCOCCUS AUREUS*, AND *PSEUDOMONAS AERUGINOSA*,

Washington Univ., St. Louis, Mo.

A. O. Summers, and E. Lewis.

Journal of Bacteriology, Vol 113, No 2, p 1070-1072, February 1973. 2 tab, 13 ref.

Descriptors: *Mercury, *Path of pollutants, *E. coli, *Bacteria, *Spectrophotometry, Laboratory tests, Analytical techniques, Pathology, Biology, Pseudomonas.

Identifiers: *Organomercurials.

Several bacterial strains carrying genes determining mercury resistance on naturally occurring plasmids will convert 0.00001 M Hg (+2) (chloride) to a form of mercury which is volatile and soluble in organic solvents. The volatilization activity is induced by exposure to HgCl₂. The ability to volatilize mercury from mercuric chloride seems to be a general mechanism of mercury resistance determined by plasmid-borne genes. From studies with a strain of *E. coli* in which the form of mercury produced is metallic mercury, it is felt likely that similar systems in other *E. coli*, *S. aureus* and *P. aeruginosa* tested are also producing metallic mercury from the added mercuric chloride. (Oleszkiewicz-Vanderbilt)

W73-11286

LEAD POLLUTION FROM A FACTORY MANUFACTURING ANTI-KNOCK COMPOUNDS,
Manchester Univ. (England). Dept. of Botany.

J. A. Lee.

Nature, Vol 238, No 5360, p 163-166, July 21, 1972. 1 fig, 1 tab, 9 ref.

Descriptors: *Lead, *Soils, *Fallout, *Vegetation, Biology, Biochemistry, Heavy metals, Pollutants, Investigations, Toxins, Industrial plants, Industrial wastes, Sampling, Soil analysis, Plant growth, Soils, *Air pollution.

Samples of mosses and leafy vegetation along with soil samples were taken from an area surrounding a factory producing anti-knock compounds and were analyzed for lead concentrations. Sampling sites were located up to 800 m from the factory and samples were taken in the early winter of 1971. Mosses were washed and digested in an acid mixture while leafy vegetation was digested without being washed. The lead concentrations were found by atomic absorption flame photometry. The lead concentrations in soil were negligible. Concentrations in vegetation decreased rapidly within the first 400 m but were still significant at the 800 m site. Concentrations as high as 286 ppm were found in a pasture within the 400 m radius. It is presumed that there is a seasonal fluctuation which must be taken into account when interpreting these data. (Jerome-Vanderbilt)
W73-11290

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

VOLCANIC EXHALATIONS AND METAL ENRICHMENTS AT MATUPI HARBOR, NEW BRITAIN, T.P.N.G., Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Bass-Backing Geobiological Lab. J. Ferguson, and I. B. Lambert. Economic Geology, Vol 67, No 1, p 25-37, 1972. 1 fig, 7 tab, 34 ref.

Descriptors: *Heavy metals, *Volcanoes, *Air pollution, *Sediments, *Dusts, Bacteria, Zinc, Manganese, Copper, Lead, Iron, Precipitation, Thermal water, Water pollution, Path of pollutants, Trace elements.

Identifiers: *Volcanic exhalations, Metal enrichment, *Matupi Harbor.

Geochemical investigations have been carried out in the volcano-exhalative-sedimentary environment at Matupi Harbor in an attempt to elucidate the potential of such environments for stratiform ore formation. Matupi Harbor is a sheltered basin with hot, acid springs which carry up to about 100 ppm iron, 100 ppm manganese, 2.5 ppm zinc, and slightly less than 0.1 ppm copper and lead. In comparison with the hot brines under the Red Sea, the Matupi springs have similar iron, manganese and zinc contents, and roughly one tenth the copper and lead contents. Laboratory studies indicate that sulfate-reducing bacteria are not noticeably active in the Matupi Harbor sediments unless organic matter is added. The apparent rarity of organic matter on the floor of the harbor was unexpected. It is concluded that stratiform iron-manganese deposits could form in volcano-exhalative-sedimentary environments if the rate of influx of detrital materials was much lower than at Matupi. For the formation of economic deposits of other metals, the conditions before, during or after precipitation, would have to be suitable for separating these metals from the predominant iron and manganese. (Oleszkiewicz-Vanderbilt) W73-11292

DISTRIBUTION OF DISSOLVED MERCURY IN THE IRISH SEA, Liverpool Univ. (England). Dept. of Oceanography. D. Gardner, and J. P. Riley. Nature, Vol 241, No 5391, p 526-527, February 23, 1973. 2 fig, 10 ref.

Descriptors: *Mercury, *Seawater, *Water analysis, *Distribution, Sediments, Heavy metals, Water pollution, Oceanography, Analysis, Trace elements, Sewage effluents, Path of pollutants, Distribution patterns.

Identifiers: *Irish Sea, *Mercury pollution.

Six cruises were made between July 1971 and September 1972 to collect samples in an area east of a line between St. Bees Head and Anglesey. The six surveys showed a consistent picture. The general levels of dissolved mercury in the inshore waters are similar to those found in the westerly regions examined in earlier cruises. These concentrations probably represent the equilibrium values for the distribution of mercury between water and suspended matter. Offshore, there are two areas in which the dissolved mercury concentration exceeds 200 ng/l. Concentrations of particulate mercury in dried sludges of up to 900 ng/l were observed in the area of the Manchester sewer outfall. Tentatively, it is suggested that the observed high concentrations of dissolved mercury found at this station were liberated during bacterial decomposition of the sludge. (Oleszkiewicz-Vanderbilt) W73-11293

TRACE ELEMENTS IN THE ATMOSPHERIC ENVIRONMENT, Atomic Energy Research Establishment, Harwell (England). For primary bibliographic entry see Field 05A. W73-11299

MERCURY IN THE MARINE ENVIRONMENT: CONCENTRATION IN SEA WATER AND IN A PELAGIC FOOD CHAIN, Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab. For primary bibliographic entry see Field 05C. W73-11300

AUTO EXHAUST - LEAD VS AROMATICS, Du Pont de Nemours (E. I.) and Co., Wilmington, Del. For primary bibliographic entry see Field 05A. W73-11301

LEAD EMISSIONS FROM INCINERATED SEWAGE SLUDGE DETECTED ON TREE FOLIAGE, Connecticut Agricultural Experiment Station, New Haven. For primary bibliographic entry see Field 05A. W73-11302

THE CASE AGAINST MERCURY, Robert A. Taft Water Research Center, Cincinnati, Ohio. For primary bibliographic entry see Field 05C. W73-11303

TRACE ELEMENTS IN THE HUMAN ENVIRONMENT, H. A. Schroeder. The Ecologist, Vol 1, No 11, p 15-19, May 1971.

Descriptors: *Trace elements, *Toxicity, *Foods, *Human pathology, Air pollution, Water pollution, Water pollution sources, Pollutants, Metals, Public health, Cadmium, Lead, Nickel, Beryllium, Antimony, Mercury, Statistics, Environment.

Although some trace elements are biologically necessary for human health, excesses have characteristics which are hazardous or harmful. Trace elements in the environment are discussed on the basis of a controlled-environment study and statistics of air, water and food contamination from the U.S. Of the 27 trace elements found in air, five which are not toxic accumulate in humans, six are essential and have not been observed at high levels of concentration, and sixteen are considered contaminants, of which six, cadmium, lead, nickel, beryllium, antimony and mercury, are considered dangerous to humans. In a U.S. Geological Survey of water supplies, 23 trace elements were looked for, of which 16 were found in sizeable quantities. Of those 16, five are essential, ten are biologically inert and only one, lead, is toxic on life-time exposure. In the case of food, the problem is not that possibly toxic metals are present, but that essential elements are removed in the refining processes. Sources of trace elements in the environment, their interactions and their effects on longevity and human health are discussed. (Jerome-Vanderbilt) W73-11304

POSSIBILITY OF REDUCING NITROGEN IN DRAINAGE WATER BY ON FARM-PRACTICES, (BIO-ENGINEERING ASPECTS OF AGRICULTURAL DRAINAGE, SAN JOAQUIN VALLEY, CALIFORNIA). Bureau of Reclamation, Fresno, Calif.

Copy available from GPO Sup Doc as EPL16:13030ELY 05/72, \$1.25; microfiche from NTIS as PB-221 482, \$0.95. Agricultural Waste-water Studies, EPA Water Pollution Control Research Series Report No. REC-R2-71-11, DWR No. 174-14, June 1972. 83 p, 18 fig, 31 tab, 23 ref. EPA Project 13030 ELY 5-72-11.

Descriptors: *Nitrates, *Fertilizers, Lysimeters, Subsurface drainage, Denitrification, Ammonia, Crop production, Municipal wastes, *California, *Farm wastes.

Identifiers: *San Luis Service Area (Calif), *Nitrogen budget, Mineralization, Organic nitrogen.

A nitrogen balance study of the San Luis Service Area determined that the average annual nitrogen contributions from all sources other than residual soil nitrogen were approximately equal to the nitrogen removal by crops and gaseous losses. This would indicate that, although in many instances the residual-nitrates would replace some of the contributed nitrogen, especially fertilizers, animal and municipal wastes, the amount of nitrates moved to the drains would be proportional to the amounts of soluble, native nitrates in the soil. A soil sampling study at several sites throughout the area indicated that there were a wide range in the concentrations of nitrates, ammonia and organic nitrogen in the soils and subsoils. There were extremely high concentrations of nitrates in those soils located on the interfan positions between the larger streams. Fertilizer studies in lysimeters show that in medium to heavy textured soils under normal irrigation and fertilizer management practices very little nitrogen is leached to the drains. Nitrate type fertilizer contributed more nitrogen to the drainage effluent than ammonia and slow release sulfur coated urea fertilizers. It was concluded that the best possibilities to reduce nitrogen in drains by on farm practices will be to establish Farm Advisory Programs to encourage the most efficient farm management and fertilizer practices and to design drain systems to promote denitrification and reduce the area swept by the drain flow lines. (EPA) W73-11324

A STUDY OF THE PHOTODEGRADATION OF COMMERCIAL DYES, Clemson Univ., S.C. Dept. of Textiles. J. J. Porter.

Copy available from GPO Sup Doc as EPL23/2-73-058, \$1.25; microfiche from NTIS as PB-221 483, \$0.95. Environmental Protection Agency, Technology Series Report, EPA-R2-73-058, March 1973. 94 p, 50 fig, 39 tab, 24 ref. EPA Project 12090 EOX.

Descriptors: *Dyes, *Chemical degradation, *Textiles, *Industrial wastes, Color. **Identifiers:** *Photodegradation.

The stability of thirty-six different commercial dyes in water to visible and ultraviolet light from a carbon arc has been studied. The dyes were selected on the basis of their importance in the textile industry from six major classes: basic, acid, direct, vat, disperse and sulfur dyes. A comparison is made for two of the dyes between laboratory fading rates and fading rates in natural sunlight. Both dyes degraded at least 10 times more rapidly in artificial light than in sunlight. Some previously identified degradation products of Basic Green 4 were confirmed, and a mechanism of their formation was proposed. A significant difference in degradation rate was observed between water-soluble dyes and pigment dispersions. This study showed that most commercial colors are resistant to photodegradation and many weeks would be required to produce appreciable dye degradation in a natural aquatic environment. (EPA) W73-11325

AERIAL SURVEILLANCE SPILL PREVENTION SYSTEM, McDonnell Aircraft Co., St. Louis, Mo. Renaissance Lab. C. L. Rudder, C. J. Reinheimer, and J. L. Berrey.

Copy available from GPO Sup Doc as EPL23/2-72-007, \$3.00; microfiche from NTIS as PB-221 484, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-72-007, August 1972. 112 p, 45 fig, 3 tab. EPA Project 15080 HOK, Contract No. 68-01-0140.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

Descriptors: Water pollution sources, Oil spills, Chemical wastes, *Remote sensing, *Aerial Photography, Photogrammetry, Water pollution control.

Identifiers: *Multiband photography, *Photographic mensuration, *Color photography, Photointerpretation, Hazardous materials.

An aerial surveillance system, consisting of four Hasselblad cameras and Zeiss RMK 1523 camera, was evaluated for the remote detection of both real and potential spills threatening inland waterways. Twenty-three multiband and baseline missions were flown over oil refineries and other industrial sites located adjacent to the Mississippi River. Baseline flights were effective in counting storage tanks, locating and identifying storage equipment and pipeline systems and determining dike conditions. Stereoscopic analysis of baseline imagery was used to estimate the height of tanks and dikes, drainage patterns and the area of openly stored waste products. The multiband imagery was obtained by combining each of nine filters with each of three different black and white films. Spectral contrast image enhancement was accomplished by either suppressing or transmitting the target reflected radiation through proper film/filter selections. Spills, effluents and waste areas were hence identified on the multiband imagery. Normal and false color imagery was evaluated with the multiband imagery to determine the best film/filter combinations for the areas of interest. Finally the personnel, equipment and procedures required to implement an aerial surveillance spill prevention system were determined. (EPA)

W73-11326

BIOLOGICAL REMOVAL OF CARBON AND NITROGEN COMPOUNDS FROM COKE PLANT WASTES,

American Iron and Steel Inst., New York.
For primary bibliographic entry see Field 05D.

W73-11328

DYESTUFF COLOR REMOVAL BY IONIZING RADIATION AND CHEMICAL OXIDATION,

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
For primary bibliographic entry see Field 05D.

W73-11329

FISH AND FOOD ORGANISMS IN ACID MINE WATERS OF PENNSYLVANIA,

Pennsylvania State Univ., University Park. Dept. of Biology.
For primary bibliographic entry see Field 05C.

W73-11332

NUMERICAL THERMAL PLUME MODEL FOR VERTICAL OUTFALLS IN SHALLOW WATER,

Oregon State Univ., Corvallis. Dept. of Mechanical and Nuclear Engineering.
D. S. Trent, and J. R. Welty.
Copy available from GPO Sup Doc as EP1.23/2-73-162, \$4.80; microfiche from NTIS as PB-221 488, \$0.95. Environmental Protection Agency, Technology Series Report, EPA-R2-73-162, March 1973. 486 p, 215 fig, 12 tab, 113 ref. EPA Project 16130 DGM.

Descriptors: *Waste water disposal, *Heated water, *Turbulent flow, Jets, Temperature, Prediction, *Thermal pollution, *Outfalls, Model studies, Water pollution control, *Heat transfer.
Identifiers: *Plume models.

A theoretical study of the heat and momentum transfer resulting from a flow of power plant condenser effluent discharged vertically to shallow, quiescent coastal receiving water is presented. The complete partial differential equations governing steady, incompressible, turbulent flow driven by both initial momentum and buoyancy are solved

using finite-difference techniques to obtain temperature and velocity distributions in the near field of the thermal discharge. Turbulent quantities were treated through the use of Reynolds stresses with further simplification utilizing the concept of eddy diffusivities computed by Prandtl's mixing length theory. A Richardson number correlation was used to account for the effects of density gradients on the computed diffusivities. Results were obtained for over 100 cases, 66 of which are reported, using the computer program presented. These results ranged from cases of pure buoyancy to pure momentum and for receiving water depths from 1 to 80 discharge diameters deep. Various computed gross aspects of the flow were compared to published data and found to be in excellent agreement. Data for shallow water plumes and the ensuing lateral spread are not readily available; however, one computed surface temperature distribution was compared to proprietary data and found also to be in reasonable agreement. (EPA)

W73-11333

ASSESSING THE WATER POLLUTION POTENTIAL OF MANUFACTURED PRODUCTS,

Little (Arthur D.), Inc., Cambridge, Mass.
J. B. Berkowitz, G. R. Schimke, and V. R. Valeri.
Copy available from GPO Sup Doc as EP1.23/2-73-179, \$0.75; microfiche from NTIS as PB-221 489, \$0.95. Environmental Protection Agency, Technology Series Report, EPA-R2-73-179, April 1973. 34 p, 12 fig, 1 tab, 2 ref. EPA Project 16080 GNC.

Descriptors: Water pollution sources, *Municipal wastes, *Domestic wastes, *Heavy metals, Pollutant identification, Pollutants, Sewage, *Waste identification, Wastes, *Industrial wastes.

Identifiers: *Manufactured products.

A Catalog has been compiled of manufactured products which may, during their normal use or disposal, result in water pollution. The Catalog is in three sections, and the products are grouped in accordance with the Standard Industrial Classification (SIC). Section I summarizes the pollution potential of each listed product group. Section II provides data on typical chemical composition for each product group and indicates the types of water-pollution effects associated with each chemical ingredient. Section III inverts Section II by providing an alphabetical listing of chemicals and the SIC codes in which they occur. Along with the Catalog, a simple model has been developed to estimate rates of pollutant entry into the waterways, via various routes. A guide including examples is provided on how to use the Catalog and associated models to assess potential water pollution problems arising from finished products in common use. (EPA)

W73-11334

RADIATION, EVAPORATION AND THE MAINTENANCE OF TURBULENCE UNDER STABLE CONDITIONS IN THE LOWER ATMOSPHERE,

Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 02D.

W73-11343

A POWER WIND LAW FOR TURBULENT TRANSFER COMPUTATIONS,

Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 02D.

W73-11344

COMPUTING EVAPOTRANSPIRATION BY GEOSTROPHIC DRAG CONCEPT,

Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 02D.

W73-11345

UNIFIED FORMULATION OF WALL TURBULENCE,
Ebasco Services Inc., New York.
For primary bibliographic entry see Field 02D.
W73-11346

SENSITIVITY OF THE SOLUTION FOR HEAT FLUX OR EVAPORATION TO OFF-DIAGONAL TURBULENT DIFFUSIVITIES,
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 02D.
W73-11347

PERTURBATION SOLUTION OF AN EQUATION OF ATMOSPHERIC TURBULENT DIFFUSION,
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 02D.
W73-11348

A SOLUTION FOR SIMULTANEOUS TURBULENT HEAT AND VAPOR TRANSFER BETWEEN A WATER SURFACE AND THE ATMOSPHERE,
Cornell Univ., Ithaca, N.Y., School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 02D.
W73-11349

A WATER-QUALITY SIMULATION MODEL FOR WELL MIXED ESTUARIES AND COASTAL SEAS VOL. V, JAMAICA BAY RAINSTORMS,
New York City-Rand Inst., N.Y.
E. C. Gitterton.
Rand Report No. R-1010-NYC, July 1972. 44p, 9 fig, 4 ref.

Descriptors: *Bays, *Estuaries, Coasts, *Storm surge, Flooding, Storm drains, *Storm runoff, *Sewage, Treatment facilities, Bacteria, Coliform, Water quality, Model studies, Simulation analysis, *New York.
Identifiers: *Jamaica Bay (NY), Spring Creek.

A simulation model measuring the effects of storm-drain flooding on the water quality of Jamaica Bay, New York, is presented. Sewage entering Jamaica Bay in dry weather is treated, but storm runoff can overflow treatment plants, whereupon untreated water enters the bay. Four runs of the model of the bay were used to simulate the effect of two typical rain storms, one at high tide and one at ebb tide. Each was simulated with and without the effects of a new treatment facility at Spring Creek. The simulations yield contrasting printouts showing coliform-bacteria concentrations both on contour maps and in concentration histories at stations in the bay. Spring Creek influences the quality of bay water more than does any other drainage basin. The new plant significantly retards the increase of bacteria in the bay following a storm; but after rainstorms, the Spring Creek facility alone cannot maintain bay water at quality standards. (See also W72-06980; W72-06979; W72-08257 and W71-04038) (Ensign-PAI)
W73-11351

NONLINEAR PARAMETER ESTIMATION IN WATER QUALITY MODELING,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.

J. S. Shastri, L. T. Fan, and L. E. Erickson.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 99, No EE3, Proceedings paper 9798, p 315-331, June, 1973. 7 fig, 7 tab, 30 ref.

Descriptors: *Water quality, *Model studies, *Statistical methods, *Biochemical oxygen demand, *Environmental engineering, Parametric

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

hydrology, Least squares method, Estimating, Computer programs, Dissolved oxygen, Systems analysis, *California.
Identifiers: "Sacramento River (Cal.)", Parametric equations, Nonlinear parameters.

Water quality in streams, lakes and estuaries is generally measured in terms of the dissolved oxygen concentration and biochemical oxygen demand. Mathematical models for describing the behavior of DO and BOD are briefly reviewed. Three specific models are examined and parameters in these models are estimated using nonlinear parameter estimation technique. Water quality data for parameter estimation were obtained from the Sacramento River survey. Statistical analysis is performed on the results obtained by calculating the residuals and F ratios for equality of variances. Results show that a model with a nonlinear decay term for BOD fits the data better than does the frequently used model with a linear decay term. (Bell-Cornell)
W73-11361

THE CHANGING CHEMISTRY OF THE OCEANS.

Proceedings of 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden. D. Dyrsen and D. Jaeger, editors. Wiley Interscience Division of John Wiley and Sons, Inc., 1972. 365 p, \$21.50.

Descriptors: *Water chemistry, *Sea water, Ocean circulation, Meteorology, Nitrogen compounds, Air-water interfaces, Films, Aerosols, Carbon dioxide, Mercury, Path of pollutants, Chlorinated hydrocarbon pesticides, Biodegradation, Ecosystems, Model studies, Sedimentation, Manganese, Dusts, Sulfides, Pyrite, Phosphates.

The 20th Nobel Symposium dealt with physical, chemical and biological processes in the oceans including air-sea and sea-bottom interactions, with special reference to man's impact on these processes. The topics discussed include ocean and atmospheric circulation, nitrous oxides in air and water, surface films, marine aerosols, carbon dioxide cycle, mercury, chlorinated hydrocarbons, microbial activity, ecosystems, sedimentary cycles, manganese nodules, airborne dust, iron sulfide, sulfur budget, and phosphate budget. (Knapp-USGS) (See W73-11368 thru W73-11386)
W73-11367

PHYSICAL MODELS OF LARGE SCALE OCEAN CIRCULATION,
Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 02E.
W73-11368

LARGE-SCALE AND LONG-TERM FLUCTUATIONS IN SOME ATMOSPHERIC AND OCEANIC VARIABLES,
National Weather Service, Silver Spring, Md. Extended Forecast Div.
For primary bibliographic entry see Field 02B.
W73-11369

NITROUS OXIDE IN AIR AND SEA WATER OVER THE ATLANTIC OCEAN,
Max-Planck-Institut fuer Chemie, Mainz (West Germany).
J. Hahn.

In: The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 53-69, 1972. 8 fig, 1 tab, 19 ref.

Descriptors: *Water chemistry, *Sea water, *Nitrogen cycle, Denitrification.
Identifiers: "Nitrous oxide."

Denitrifying bacteria in soil can produce N₂O so that this compound is expected to be in the atmosphere. Soil bacteria are the major source and photochemical dissociation in the troposphere and stratosphere is the major sink for N₂O. All N₂O data show a very systematic decrease in concentration with altitude. N₂O data were collected from the surface air of large sections of the Atlantic Ocean. The N₂O concentration in seawater was measured at the same stations. Some high N₂O supersaturations are found in seawater. This may indicate N₂O production in the sea. (See also W73-11367) (Knapp-USGS)
W73-11370

IMPACT OF NATURAL AND MAN-MADE SURFACE FILMS ON THE PROPERTIES OF THE AIR-SEA INTERFACE.

Naval Research Lab., Washington, D.C. Ocean Science Div.

W. D. Garrett.

In: The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 75-91, 1972. 4 fig, 33 ref.

Descriptors: *Oil-water interfaces, *Oily water, *Sea water, Monomolecular films, Oil spills, Path of pollutants, Surface tension, Surfactants, Air-water interfaces.

Identifiers: Surface films (Sea water).

Oceanic surface films influence various properties of the air-sea interface and modify exchange processes between the atmosphere and the ocean. Small waves are resisted and attenuated, and the interaction between wind and waves is uncoupled through the elimination of form drag. Gas exchange is inhibited by films of oil, but not to a serious extent in the open ocean. Liquid-solid exchange is altered, organic fallout is concentrated at the surface by organic films, and a mechanism exists whereby oil is transported into the marine atmosphere where it may influence atmospheric processes. In general, a large sea slick or oil film serves to damp its environment by replacing a high-surface-tension, dynamic water surface with a more phlegmatic, less mobile, organic-air interface. Although the ratio of contaminant to natural film-forming material in the sea is increasing, the natural oceanic background of organic matter is still large in comparison to the man-made input. However, spills of oil, river inputs or ocean dumping can create localized conditions where the resulting surface films are predominantly a result of human activity. (See also W73-11367) (Knapp-USGS)
W73-11371

SOME ASPECTS OF THE GEOCHEMISTRY OF MARINE AEROSOLS.

Centre National de la Recherche Scientifique, Gif-sur-Yvette (France). Centre des Faibles Radioactivities.

For primary bibliographic entry see Field 02K.
W73-11372

THE CHEMICAL STABILITY OF THE OCEANS AND THE CO₂ SYSTEM,

Oregon State Univ., Corvallis. Dept. of Oceanography.

For primary bibliographic entry see Field 02K.
W73-11374

MERCURY—A CASE STUDY OF MARINE POLLUTION,

World Health Organization, Copenhagen (Denmark), Regional Office for Europe.

A. Jernelov.

In: The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 161-169, 1972. 7 fig, 8 ref.

Descriptors: *Mercury, *Path of pollutants, *Sea water, *Trophic level, Water chemistry, Organic matter, Food chains, Translocation, Water pollution sources, Water pollution effects.

Mercury in water exists almost entirely bound to suspended particles. Conversion of inorganic mercury to methyl mercury occurs in the surface layer of the sediment or on suspended organic particles in the water. A normal conversion rate in a Swedish lake is 0.1% per year of the total mercury present. In an oligotrophic system most energy and matter on one trophic level is transferred to the next. In an eutrophic system a larger proportion of the energy and matter on one trophic level goes to decomposition and a smaller proportion is transferred to the next trophic level. This means that a smaller proportion of the methyl mercury which accumulates in organisms will reach the top predators with the critical concentrations. If there is a high nutrient level in the aquatic system, the sedimentation rate will be high and thus tend to cover the mercury-rich sediment. Tidal areas and estuaries are favorable for high methylation rates, which could mean that the organisms there naturally contain high concentrations of mercury, but also that they are specially sensitive to further contamination. Due to the extreme oligotrophic characteristics of the high sea and lack of buffering sediment, marine top predators can increase their mercury levels as an effect of changes in the ecosystem other than an increase in the total mercury concentration. (See also W73-11367) (Knapp-USGS)
W73-11375

A FEW COASTAL POLLUTION PROBLEMS IN JAPAN,
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
For primary bibliographic entry see Field 05C.
W73-11376

CHLORINATED HYDROCARBONS IN OPEN-OCEAN ATLANTIC ORGANISMS,

Woods Hole Oceanographic Institution, Mass.
G. R. Harvey, V. T. Bowen, R. H. Backus, and G. D. Grice.

In: The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 177-186, 1972. 1 fig, 1 tab, 16 ref.

Descriptors: *Atlantic Ocean, *Chlorinated hydrocarbons, *DDT, Polychlorinated biphenyls, Food chains, Absorption, Fish, Crustaceans, Surface waters, Deep water.

Identifiers: Cape Verde Islands, Bermuda.

A series of organisms collected from the open North Atlantic Ocean demonstrated PCB in all samples and DDT in most samples. No strong evidence was obtained of an east-west gradient in concentration between the Cape Verde Islands and Bermuda. These findings agree with a systematic increase in concentration along food chains, although the mechanisms of uptake may be different for PCB than for DDT. Fish and crustacea which feed near the sea surface at night but move to considerable depths during the day show DDT and PCB concentrations to be quite similar to those of predaceous organisms that remain mostly in the upper layers. This may indicate that biological removal processes help to control chlorinated hydrocarbon concentrations in the open ocean. (See also W73-11367) (Ensign-PAI)
W73-11377

MICROBIAL ACTIVITY AS A BIOGEOCHEMICAL FACTOR IN THE OCEAN,
Akademii Nauk SSSR, Yaroslavl. Institut Biologii Vnutrennykh Vod.
Y. I. Sorokin.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

In: *The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 189-204, 1972.* 11 fig, 5 tab, 26 ref.

Descriptors: *Aquatic microorganisms, *Biochemistry, *Sea water, *Biodegradation, Food chains, Water chemistry, Organic matter, Sulfur, Nitrogen, Aquatic bacteria, Geochemistry. Identifiers: Biogeochemistry.

The metabolism of the microbial population of the ocean is a basic agent in the biogeochemical turnover of the aquatic environment. During the process of microbial decomposition, most of the organic matter entering the water basin or having been produced in it is oxidized. The decomposing activity of chemosautotrophic bacteria is responsible for the turnover of sulfur, nitrogen and iron. Anaerobic decomposition promotes oxidation of organic molecules and reduction of sulfur and nitrogen compounds. (See also W73-11367) (Knapp-USGS) W73-11378

ON THE AGE OF STABLE ORGANIC MATTER—AQUATIC HUMUS IN OCEANIC WATERS,
Akademiya Nauk SSSR, Yaroslavl. Institut Biologii Vnutrennykh Vod.
B. Skopintsev.

In: *The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 205-207, 1972.* 17 ref.

Descriptors: *Organic matter, *Sea water, *Humus, Suspended load, Aqueous solutions, Biodegradation, Bottom sediments, Sedimentation.

Dissolved organic matter from the deep (1,900 m) waters of the Northeast Pacific Ocean, is 3,400 years old, whereas the carbon in the inorganic matter is only from 2,194 to 1,480 years old. About 80% of the dead residue of plankton and bacteria consists of easily assimilated organic compounds and the remainder, 20%, of newly formed organic matter in the form of very complex compounds, characterized by a relatively high biological stability. This is the aquatic humus, about 1/4 existing in dissolved form, and 3/4 in suspended form. About 5% of organic carbon reaches the bottom of the oceans yearly in the form of particles. The total annual income of aquatic humus to the ocean is 13.3 times 10 to the 14th power g/year. (See also W73-11367) (Knapp-USGS) W73-11379

FACTORS CONTROLLING MARINE ECOSYSTEMS,
Marine Lab., Aberdeen (Scotland).
For primary bibliographic entry see Field 05C.
W73-11380

CHEMICAL CYCLES WITH ENERGY CIRCUIT MODELS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 02A.
W73-11381

MAN'S ROLE IN THE MAJOR SEDIMENTARY CYCLE,
Scripps Institution of Oceanography, La Jolla, Calif.
E. D. Goldberg.

In: *The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 267-288, 1972.* 10 tab, 33 ref.

Descriptors: *Sedimentation, *Leakage, Pollutants, *Halogenated pesticides, *Oils, *Heavy metals, *Lead, *Mercury, Metals, Radioisotopes, Fossil fuels.

Identifiers: Halogenated hydrocarbons.

components, and their growth is often not continuous in time. On the average they accumulate at the rate of about a few cms per million yrs. (See also W73-11367) (Knapp-USGS)
W73-11384

THE ACCELERATION OF THE HYDROGEOCHEMICAL CYCLING OF PHOSPHORUS,

Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).

W. Stumm.

In: *The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., N.Y., p 329-346, 1972.* 9 fig, 1 tab, 27 ref.

Descriptors: *Coasts, *Estuaries, *Phosphorus, Balance of nature, Ecology, *Oxygen requirements, Sewage, Drainage, Industrial wastes, Storm runoff, Nutrients.

Identifiers: *Hydrogeochemical cycling, Mineralization, Anoxic conditions.

GEOLOGICAL, GEOCHEMICAL AND ENVIRONMENTAL IMPLICATIONS OF THE MARINE DUST VEIL,

Liverpool Univ. (England). Dept. of Oceanography.

R. Chester.

In: *The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 291-305, 1972.* 1 fig, 6 tab, 28 ref.

Descriptors: *Path of pollutants, *Sedimentation, *Dusts, *Sea water, *Water chemistry, Fallout, Heavy metals, Lead, Zinc, Mercury, Cadmium, Pesticides, Winds.

There is a veil of continentally supplied dust over the oceans. The presence of this dust veil has important geological, geochemical and environmental implications. One of the most important of these may be that the atmosphere provides a transport pathway for solid material to the oceans which is genetically different from that of river transport. Solids brought by dust and by river sediments behave differently in their reactions with seawater. Some trace element removal occurs when the dusts enter the water column. The presence of the dust veil over the oceans offers a mechanism for the input of pollutants to seawater. Some pollutants are introduced directly into the atmosphere. Among these are pesticides from crop spraying, solids and gases as waste products of social and industrial activity, and volatile elements such as Zn, Hg, Pb, and Cd. (See also W73-11367) (Knapp-USGS) W73-11383

MANGANESE NODULES AND BUDGET OF TRACE SOLUBLES IN OCEANS,

Tata Inst. of Fundamental Research, Bombay (India).

S. Krishnasamy, and D. Lal.

In: *The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 307-320, 1972.* 1 fig, 5 tab, 43 ref.

Descriptors: *Trace elements, *Sea water, *Manganese, *Bottom sediments, Water chemistry, Geochemistry, Chemical precipitation, Sedimentation.

Identifiers: *Manganese nodules.

Manganese nodules were used for studying the rates of authigenic removal of trace elements to the ocean floor. In the open ocean, manganese nodules grow by accumulation of hydrogenous

The global phosphorus circulation and the effects of man's activities on it are analyzed. The increased mining and use of phosphorus disturbs the ecological balance and creates undesirable conditions in inland waters, estuaries and coastal waters. The increase in phosphorus, although of little consequence to the oxygen reserves of the deep waters, augments markedly the marine environments with intermittent or permanent oxygen deficient conditions. Present drainage systems for sewage, industrial wastes and storm water runoff accelerate the transport of nutrients and other pollutants to the rivers and the sea. The trapping of nutrients is most efficient in estuaries and fjords. Algae grown from these nutrients are carried seaward and eventually settle and become mineralized. The products from this mineralization are carried landward producing anoxic conditions in coastal waters. Examples are given of several Norwegian fjords and parts of the Baltic Sea. (See also W73-11367) (Ensign-PAL) W73-11385

SULFATE REDUCTION, PYRITE FORMATION, AND THE OCEANIC SULFUR BUDGET,

Yale Univ., New Haven, Conn. Dept. of Geology and Geophysics.

R. A. Berner.

In: *The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 347-361, 1972.* 5 fig, 4 tab, 22 ref.

Descriptors: *Water chemistry, *Sea water, *Sulfur, Sulfides, Sulfates, Pyrite, Weathering, Chemical precipitation, Sedimentation, Hydrogen sulfide, Dissolved oxygen, Oxidation-reduction potential.

Identifiers: Sulfur budget.

Every year 368 million tons of dissolved sulfate are delivered to the ocean by rivers. Only two processes are of possible importance in removing this sulfate from seawater. One is the precipitation of calcium sulfate and the other is the bacterial reduction of sulfate to hydrogen sulfide which is precipitated as pyrite, FeS₂. Calcium sulfate is considerably undersaturated in normal seawater so that evaporation to salinities over three times the average is necessary to reach saturation. The present ocean contains no significant evaporite basins where calcium sulfate is precipitated. Therefore, dissolved sulfate must be removed from the ocean at present by the formation of sedimentary pyrite. The primary limitations upon how much sulfate can be ultimately removed from seawater and fixed as pyrite are: the availability of bacteriologically metabolizable organic matter; the

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

concentration and rate of deposition of detrital iron compounds which can react with H₂S to form iron sulfides; and the rate of replenishment of sulfate in the sediment via diffusion from the overlying water. The annual removal of sulfur is estimated to be 6 million tons per year. This is far less than the amount delivered by rivers. Unless considerable sulfur is removed in shallow water, especially within deltaic complexes where there are high rates and large volumes of sedimentation, it appears that the oceans are badly out of balance relative to the removal of sulfur. (See also W73-11367) (Knapp-USGS)
W73-1136

A STUDY OF COASTAL WATER QUALITY IN THE VICINITY OF SAN JUAN, PUERTO RICO, JANUARY 13-31, 1971.

Environmental Protection Agency, Athens, Ga.
Southeast Water Lab.

Available from NTIS, Springfield, Va. 22151 as PB-213 445 Price \$3.00 printed copy; \$0.95 microfiche. Technical Services Program Publication, February 1971. 42 p, 6 fig, 12 tab.

Descriptors: *Water quality, *Water pollution sources, *Estuaries, *Puerto Rico, *Water analysis, Chemical analysis, Industrial wastes, Dissolved oxygen, Water temperature, Hydrogen ion concentration, Oil wastes, Bacteria, Coliforms, Plankton, Sediments, Tidal effects, Bays, Coasts. Identifiers: *San Juan area (PR).

A water quality investigation in the coastal environs of the greater San Juan, Puerto Rico, area was conducted during the period January 13-31, 1971. The primary purpose was to document the extent of water pollution in the San Juan area with particular reference to violations of Puerto Rico's Coastal Water Quality Standards. San Juan Bay, Martin Pena Canal, and San Jose Lagoon are classified for industrial use in the Standards. Water quality criteria for this classification include: a minimum dissolved oxygen (DO) concentration of 4.5 mg/liter; a maximum temperature of 93 deg F or no more than 4 deg F above ambient; and a pH between 6.8 and 8.5. Analyses of samples taken in upper San Juan Bay showed DO violations in 41% of all samples taken. The pH was greater than 8.5 in 63% of the samples from San Jose Lagoon and greater than 8.5 in samples from Martin Pena Canal. Cooling water discharges from the Palo Seco thermal power plant caused temperatures to exceed 93 deg F at the mouth of the Bayamon River. Also included are data on bacteria, chemical analysis, plankton, oil, solids, and sediments. (Woodard-USGS)
W73-11388

AN INVESTIGATION OF FLOODS IN HAWAII THROUGH SEPTEMBER 30, 1972.

Geological Survey, Honolulu, Hawaii. Water Resources Div.
For primary bibliographic entry see Field 02E.
W73-11404

ROLE OF IRON SULFIDES IN THE ACCUMULATION OF TRACE ELEMENTS IN BLACK SEA SEDIMENTS (ROL' SUL'FIDOV ZHELEZA PRI NAKOPENIJI MIKROELEMENTOV V OSADKAKH CHERNOGO MORYA),

Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W73-11409

SOME PROBLEMS IN THE GEOCHEMISTRY OF MOLYBDENUM IN THE MEDITERRANEAN SEA (NEKOTORYYE VOPROSY GEOKHIMII MOLIBDENA V SREDIZEMNOM MORE),

Akademiya Nauk SSSR, Gelendzhik. Institut Okeanologii.

For primary bibliographic entry see Field 02K.
W73-11410

CONDITIONS OF PRESERVATION OF CHLOROPHYLL, PHEOPHYTIN, AND HUMIC SUBSTANCES IN BLACK SEA SEDIMENTS (USLOVIA SOKHRANNOSTI KHLOROFILLA, FEOPFITINA I GUMMINOVYKH VESCHESTV V OTLOZHENIYAKH CHERNOGO MORYA),

Akademiya Nauk SSSR, Moscow. Institut Geokhimii i Analiticheskoi Khimi.

For primary bibliographic entry see Field 02J.
W73-11411

and Mn are 36%, 34% and 48% respectively. Thorium shows a 47% decrease in concentration. This concentration gradient in the topmost layer is ascribed to chemical influxes resulting from cultural development in the region. Since it is likely that diffusion into the sediment is taking place and that redistribution of the elements is taking place as decay of the organic material proceeds, it is not possible to calculate with any accuracy the total burden of these elements that has been imposed upon the lake. The rare-earth element results show that Ep-pH conditions which change through time, have an important effect on those elements capable of existing in more than one oxidation state.
W73-11427

DISTRIBUTION AND COMPOSITION OF MINERAL WATER IN THE TUVA AUTONOMOUS REPUBLIC (ZAKONOMERNOSTI RASPROSTRANENIYA I SOSTAV PODZEMNYKH MINERAL'NYKH VOD TUVY),

Institut Zemnoi Kory, Irkutsk (USSR).
For primary bibliographic entry see Field 02F.
W73-11412

DISTRIBUTION OF TRACE ELEMENTS IN BODIES OF WATER OF KAZAKHSTAN (RASPREDELENIYE MIKROELEMENTOV V VODOVYEMAKH KAZAKHSTANA),

Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Khimicheskikh Nauk.
For primary bibliographic entry see Field 02K.
W73-11413

COMBINED EFFECT OF THERMAL AND ORGANIC POLLUTION ON OXYGEN SAG CURVE,

Worcester Polytechnic Inst., Mass.
For primary bibliographic entry see Field 05C.
W73-11423

VOLUME TRANSPORT, SALINITY DISTRIBUTION AND NET CIRCULATION IN THE DULPEN ESTUARY, GEORGIA,

Georgia Univ., Sapelo Island. Marine Inst.
For primary bibliographic entry see Field 02L.
W73-11425

MAJOR AND TRACE ELEMENT LOADING OF CENTRAL MICHIGAN LAKES,

Michigan State Univ., East Lansing. Dept. of Geology.
C. M. Spooner.
Available from the National Technical Information Service as PB-221 536, \$3.00 in paper copy, \$0.95 in microfiche. Project Completion Report, Michigan State University, Institute of Water Research, June 1973. 21 p, 2 fig, 5 tab, 11 ref. OWRR A-068-MICH (1), 14-31-0001-3822.

Descriptors: Sedimentation, *Lakes, Chemical reactions, *Michigan, Water pollution sources, Trace elements, *Lake sediments.
Identifiers: *Lake Lansing (Mich), Kettle Lake (Mich).

This preliminary investigation was undertaken to determine major, minor and trace element levels and their variation with depth in recent sediment cored from a small medi-Michigan lake. The objective is to identify chemical gradients in the unconsolidated sediment and correlate them with human activity in the area.

During the geologically recent human occupation of the region, it was expected that certain metals introduced into the lake water would become incorporated in some fashion into the sedimentary column. A core from Lake Lansing, Michigan penetrating to a depth of 60 cm sampled in 30 cm layer of organic material and 30 cm of an underlying clay. Concentration profiles with depth show increases in the uppermost layer for sodium, potassium and manganese when compared to concentration means from the 20 to 60 cm depth. The percentage increases for Na, K,

INVESTIGATIONS INTO THE OCCURRENCE OF COLIFORM ORGANISMS FROM PRISTINE STREAMS,

Michigan State Univ., East Lansing. Dept. of Microbiology.
W. N. Mack.

Available from the National Technical Information Service as PB-221 537, \$3.00 in paper copy, \$0.95 in microfiche. Project Completion Report, Michigan State University, Institute of Water Research, June 1973. 17 p, 1 fig, 8 tab, 9 ref. OWRR A-068-MICH (1), 14-31-0001-3822.

Descriptors: *Coliforms, Aquatic microorganisms, *Water pollution sources, Lake Michigan, *Bioindicators, Pollutant identification.
Identifiers: *Lactose fermentation, *Millecoquins River (Michigan), Lake Millecoquins (Michigan).

Samples of water taken from the shoreline of northern Lake Michigan contain relatively large numbers of coliform organisms. After testing the water off-shore in Lake Michigan, it was determined that the coliform organisms along the beach of northern Lake Michigan probably came from the rivers and creeks emptying into the lake. During the summer of 1971, a survey was made of all streams emptying into Lake Michigan from the Millecoquins River, west of the village of Naubinway, Mich., to Scott Point, south of the village of Gould City, Mich. Small creeks and streams feed Millecoquins Lake which in turn is drained by the Millecoquins River into Lake Michigan. The river is a waterway draining an area where man has populated the surface and maintained domestic animals. Most of the streams entering Lake Michigan have their source in remote areas where there are no farms and except for a few hunters and fishermen during their respective seasons, these areas are isolated. Recent findings by other investigators indicate that the coliform organisms are widespread in nature and suggest that the animal populations in remote areas are responsible for the dissemination of the organisms. It appears that the coliform organisms are part of the natural habitat of these streams and cannot be used as an index of fecal pollution. The present study was designed to show that the lactose fermenting coliform organisms present in these streams are part of the natural flora of the stream and that under certain conditions these organisms multiply in the water, thus accounting for their large numbers.
W73-11428

PREDICTION MODELING FOR SALINITY CONTROL IN IRRIGATION RETURN FLOWS,

Robert S. Kerr Environmental Research Lab., Ada, Okla.
For primary bibliographic entry see Field 05G.
W73-11441

IRON BACTERIA—A LIKELY SUBJECT OF CO-ORDINATED RESEARCH,

P. Stumes.
Water and Pollution Control, Vol 106, No 1, p 34-35. January, 1968.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

Descriptors: Corrosion, Corrosion control, Bacteria, Iron *Iron bacteria, Chlorination, Water supply, Water wells, Microorganisms, Soil microorganisms, *Soil bacteria, *Research priorities, Pipes, Domestic water, Canada.
Identifiers: Testing laboratories.

Inconveniences and nuisances caused by the presence of iron bacteria include: the filamentous wastes of some species which form unsightly specks in water; ferrous compounds which stain laundry a reddish color, oily by-products which impart an unpleasant taste and odor to water; clogging of pipes, filters, etc. by bacterial colonies or their accumulated wastes; and the acceleration of corrosion by certain types of bacteria. Quite frequently, the presence of iron bacteria is not even recognized. Often the cause of complaint is assumed to be a form of mineral iron; regular iron removal techniques are in these cases ineffective. Some suggestions are offered as to potential areas for research with regards to defining the soil types, depth levels, water chemistries, motive forces, etc. important to the life systems of iron bacteria. The intent is to stimulate discussion and exchange of opinion which could provide impetus for research on the subject of iron bacteria at many levels. (Campbell-NWWA)

W73-11471

ORGANIC LOADING OF PETENWELL RESERVOIR, WISCONSIN,
 Wisconsin Univ., Madison.
 For primary bibliographic entry see Field 05C.
 W73-11486

REPORT ON EVALUATIONS OF WASTE SOURCES IN THE CALCASIEU RIVER BASIN, LOUISIANA.
 National Field Investigations Center-Denver, Colo.

Available from NTIS, Springfield, Va 22151, as PB-213 781 Price \$3.00 printed copy; \$0.95 microfiche. Environmental Protection Agency Office of Enforcement Report, January 1972. 202 p., 15 fig, 47 tab, 5 ref, 7 append.

Descriptors: *Water pollution sources, *Industrial wastes, *Water quality, *Louisiana, Streams, Bayous, Chemical analysis, Chemical industry, Oil industry, Pulp and paper industry, Thermal pollution, Pollution abatement.
Identifiers: Calcasieu River basin (La.).

The Calcasieu River basin in the southwestern corner of Louisiana is the State's second largest industrialized area. Industries on the lower portion of the Calcasieu River are principally involved in the production of chemicals, petrochemicals, and petroleum products. Several firms on the upper portions of the river are processing tall oil and producing Kraft paper. All of these industries are discharging waste waters into the Calcasieu River or its tributaries. An industrial waste inventory is presented including information on the types of materials produced and raw materials used at each plant, as well as the process additives, water supplies, and wastewater treatment procedures. Fourteen industries discharge daily at least 82,000 lbs of COD; 597,000 lbs of TOC; 601,000 lbs of suspended solids; and 22.4 X 10 to the 12th power calories of heat. Analyses of bottom sediments showed that industrial waste solids are being deposited in the Calcasieu River, a navigable stream, and in its tributary streams and bayous. (Woodard-USGS)
 W73-11529

MOVEMENT OF ACAROL AND TERBACIL PESTICIDES DURING DISPLACEMENT THROUGH COLUMNS OF WABASSO FINE SAND.
 Florida Univ., Gainesville. Dept. of Soil Science.

R. S. Mansell, W. B. Wheeler, L. Elliott, and M. Shaurett.
 In: Proceedings of Soil and Crop Science Society of Florida, Vol 31, p 239-243, December 1971. 6 fig, 2 tab, 9 ref. OWRR A-013-FLA (5).

Descriptors: *Water pollution sources, *Pesticides, *Path of pollutants, Laboratory tests, Analytical techniques, Soil types, Sands, Soil management, Agronomy, Citrus fruits, Vegetable crops, Evaluation.
Identifiers: *Acarol, *Terbacil.

Experiments were conducted to evaluate water pollution potential from pesticides. Aqueous solutions of C-14 labeled Acarol miticide and Terbacil herbicide were displaced through 30 cm columns of Wabasso fine sand taken from 0-10 and 33-76 cm profile depths. The pesticides were applied to each column when the soil was initially air-dry and later after the soil had attained water saturation. Each application had a volume of 25 ml and solute concentrations of 1 ppm miticide or herbicide and 3.3 ppm Cl (as NaCl). Liquid scintillation measurements of C-14 and Cl radiations in equal portions of column effluent with time was used to construct breakthrough (elution) curves for each solute. Analysis of these curves revealed that relative mobilities for the solutes in Wabasso fine sand were in the order, Cl>Terbacil>Acarol. Only negligible movement of Acarol was observed for each column displacement. (Woodard-USGS)
 W73-11537

CRUDE OIL BEHAVIOR ON ARCTIC WINTER ICE.
 Coast Guard, Washington, D.C. Pollution Prevention Projects Branch.
 T. J. McMinn.

Available from NTIS, Springfield, Va 22151 as AD-754 261 Price \$4.85 printed copy; \$0.95 microfiche. Coast Guard Office and Research and Development Final Report, 1972. 67 p., 21 fig, 3 tab, 7 ref, 3 append.

Descriptors: *Oil spills, *Cold regions, *Ice, *Snow, *Arctic, On-site investigations, Testing procedures, Movement, Absorption, Tracking techniques, Path of pollutants.
Identifiers: Oil spill removal.

Oil spill behavior in an Arctic winter environment was investigated using small controlled oil spills during January 1972 on the Bering Sea in northwestern Alaska. To duplicate a real world spill as closely as possible, a Prudhoe Bay crude oil was used as the test oil. Investigated were oil spread rates on snow and ice, oil absorption into snow and ice surfaces, aging of oil on snow and ice surfaces, and effectiveness of various cleanup procedures. Oil spreading over ice and snow is dominated by gravity and inertia forces. Spreading rate is independent of the properties of the oil and is not affected by temperature. Terminal pool size of a known volume of oil is, however, indirectly related to temperature. Basic detection and recovery problems exist when spilled oil is subjected to snowfall or high winds. Snow tends to combine with pooled oil until the oil is effectively saturated with snow crystals. The resulting mixture may be as high as 80% snow. After saturation (which can happen in a few hours time) additional snow covers the oil making visual detection of areal extent impossible. The oil snow mixture is quite easily handled mechanically (shovel, bulldozer, etc.) but cannot be burned or absorbed. (Woodard-USGS)
 W73-11539

THE ENVIRONMENTAL TRITIUM CONCENTRATION OF UNDERGROUND WATER AND ITS HYDROLOGICAL INTERPRETATION,
 Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia). Div. of Soils.
 For primary bibliographic entry see Field 02F.

W73-11544

RADIONUCLIDES IN TRANSPORT IN THE COLUMBIA RIVER FROM PASCO TO VANCOUVER, WASHINGTON,
 Geological Survey, Washington, D.C.
 W. L. Haushild, H. H. Steven, Jr., J. L. Nelson, and G. R. Dempster, Jr.
 Available from GPO, Washington, D.C. 20402 Price \$0.75. Geological Survey Professional Paper 433-N, 1973. 43 p., 13 fig, 35 tab, 35 ref.

Descriptors: *Path of pollutants, *Radioactive wastes, *Radioisotopes, *Columbia River, Cooling water, Water pollution sources, Washington, Radiochemical analysis.
Identifiers: *Hanover (Wash.).

Radiation in the Columbia River originated in discharges of cooling-water effluent from the reactors on the U.S. Atomic Energy Reservation at Hanford, Washington. All the contributing reactors were shut down by 1971. A progressive decrease in the concentrations and discharges of many radionuclides during the study period was attributable to the decrease in the number of operating reactors. Concentrations and discharges of the radionuclides also varied seasonally in patterns that were used to categorize the particulate and dissolved radionuclides into five classes. Concentrations of radionuclides in classes 1, 2, and 4 varied seasonally in dissolved parent materials in the cooling water. Concentrations of class 3 radionuclides varied with dilution of a source with constant strength. Concentrations of class 5 radionuclides varied with the seasonal variation in water discharge. Specific activities of zinc-65 and chromium-51 at Vancouver varied inversely with concentration of suspended sediment. The hydrodynamic and sedimentation characteristics of the Columbia River and the chemical characteristics of the radionuclides were important factors affecting the disposition of the radionuclides discharged at Pasco. (Knapp-USGS)
 W73-11549

DISPOSAL OF URANIUM-MILL EFFLUENT BY WELL INJECTION IN THE GRANTS AREA, VALENCIA COUNTY, NEW MEXICO,
 Geological Survey, Washington, D.C.
 For primary bibliographic entry see Field 05E.
 W73-11551

MEASUREMENT OF SALT-WEDGE EXCURSION DISTANCE IN THE DUWAMISH RIVER ESTUARY, SEATTLE, WASHINGTON, BY MEANS OF THE DISSOLVED-OXYGEN GRADIENT,
 Geological Survey, Washington, D.C.
 W. A. Dawson, and L. J. Tilley.

Available from GPO, Washington, D.C. 20402 Price \$0.25 (paper cover). Geological Survey Water-Supply Paper 1873-D, 1972. 27 p., 11 fig, 10 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Estuaries, *Tidal effects, *Washington, Data collections, Methodology, Water quality, Dissolved oxygen, Salinity, Saline water intrusion, Water levels, Tides, Water temperatures, Correlation analysis, Tracking techniques.
Identifiers: Duwamish River estuary (Wash.), Salt-wedge movement, Dissolved oxygen gradient.

The Duwamish River estuary in the State of Washington has been the object of a series of comprehensive studies to predict the effects of the changing character of waste-water inputs on the water quality of the estuary. Freshwater and saltwater relations of the estuary are discussed. The distance that the saltwater wedge in the estuary moves upstream and downstream with the tide is measured by a method that utilizes the persistence of the longitudinal gradient of dissolved oxygen in the saltwater of the wedges. The method, though

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

unorthodox, can serve as an independent check on any other measurements of tidal-excursion distance. Typical values obtained were a 1-km excursion for a 1.3-m tide range and a 3-km excursion for a 3-m tide range. This method of tracing the water movement seems to work because of two unusual aspects of the Duwamish River estuary: (1) the channel configuration is simple and well-suited to synoptic measurement, and (2) the physical properties of the entering saltwater are nearly constant. (Woodard-USGS)
W73-11564

SYSTEM STUDY FOR SURVEILLANCE OF OCEAN DUMPING OPERATIONS.

Sperry Rand Corp., Great Neck, N.Y. Sperry Systems Management Div.

Available from NTIS, Springfield, Va 22151 as AD-735 378, Price \$3.00 printed copy; \$0.95 microfiche. Publication No GB-2500-1072 (NP), September 1971. 219 p, 13 fig, 3 tab, 19 ref, 9 append. ACE Contract DACW 51-71-C-0024.

Descriptors: *Water pollution sources, *Waste disposal, *Solid wastes, *Tracking techniques, Instrumentation, Barges, Atlantic Ocean, New York, Remote sensing, Radar, Evaluation.

Identifiers: *Ocean dumping operations, *New York Bight.

A study of surveillance of ocean dumping operations in the New York Bight is described. General requirements, system approaches, and system specifics are discussed. Applicable candidate systems are described and are rated using customized evaluation and analysis techniques, including consideration of total cost of ownership. The preferred system thus defined is described in the text and in appended hardware procurement and installation specifications. The preferred system utilized Loran A for position fixing, draft sensing for detecting the occurrence of dump, and means for recording these as well as important events. For maximum application flexibility, a dump detection subsystem is added to a basic system. The basic system, contained in a single black-box, requires minimal vessel preparation and has the advantages of transportability in that it can be placed aboard a vessel upon short notice. No system configuration requires a connection between towed dumper and the towing tug. Furthermore, the preferred system requires no major development effort. The system concept involves the recording every six minutes of vessel position as determined by automatic tracking Loran receivers, the recording of important events as they occur, and the recording of draft sensing if desired. Provision is also made for recording other dump status signals like dump valve status. (Woodard-USGS)
W73-11573

PETROLEUM HYDROCARBONS AND FATTY ACIDS IN WASTEWATER EFFLUENTS.

Woods Hole Oceanographic Institution, Mass.

J. W. Farrington, and J. G. Quin.

Journal Water Pollution Control Federation, Vol 45, No 4, p 704-712, April 1973. 2 fig, 2 tab, 28 ref.

Descriptors: *Waste water (Pollution), *Sewage effluents, *Pollutant identification, *Sewage treatment, *Oil, Separation techniques, Treatment facilities, Organic compounds, Solvent extractions, Lipids, Water sampling, Gas chromatography, Organic acids.

Identifiers: *Fatty acids, *Flame ionization gas chromatography, Sample preparation, Animal fat, Vegetable oil, Chemical concentration, Hydrocarbons, Column chromatography, Thin layer chromatography, Organic solvents.

Samples of the effluent from three secondary treatment plants were surveyed to determine fatty acid and hydrocarbon distributions and concentra-

tions. The samples were obtained in glass containers with aluminum-lined caps. Lipid extracts were obtained by either (1) extracting the acidified effluent with chloroform, saponifying the lipid residues with 0.5 N KOH in (1:1) benzene:methanol, acidifying the saponified extract, and partitioning the lipids into petroleum ether; or (2) refluxing subsamples with 0.5 N KOH in (1:1) benzene:methanol, acidifying the extract and partitioning the lipids into petroleum ether. Fatty acid analysis was carried out using flame ionization gas chromatography. Hydrocarbons were also analyzed by gas chromatography after isolation from the effluent lipid extracts by column and thin-layer chromatography. The analyses confirm that the predominant fatty acids ratios in effluents are 16:0, 18:0, 18:1. The relative abundance of these acids suggests animal fats and vegetable oils as their sources. Concentrations of fatty acids ranged from 0.73 to 43.05 mg/l. Petroleum hydrocarbons are discharged by two of the treatment plants studied. Hydrocarbon concentrations ranged from none detected for the effluent of one treatment plant to 16.2 mg/l for the effluent of another. These results confirm suggestions that significant amounts of petroleum hydrocarbons are discharged in effluents. (Holoman-Battelle)
W73-11575

DDT, DDE, AND POLYCHLORINATED BIPHENYLS IN BIOTA FROM THE GULF OF MEXICO AND CARIBBEAN SEA—1971,

Texas A and M Univ., College Station. Dept. of Chemistry.

C. S. Giam, A. R. Hanks, R. L. Richardson, W. M. Sackett, and M. K. Wong.

Pesticides Monitoring Journal, Vol 6, No 3, p 139-143, December 1972. 1 fig, 2 tab, 9 ref.

Descriptors: *Pesticide residues, *DDT, *DDE, *Polychlorinated biphenyls, *Crabs, *Shrimp, *Marine fish, Chlorinated hydrocarbon pesticides, Gas chromatography, Sampling, Freezing, Crustaceans, Mollusks, Invertebrates, Elasmobranchs, Sharks.

Identifiers: *Biological samples, Sample preparation, Flounders, Cephalopods, Squid, Sea panpy, Flying fish, Tunicates, Squirrelfish, Batfish, Croakers, Rock shrimp, White tip shark, King mackerel, Tuna, Parrot fish, Red snapper, Triggerfish, Yellow tail snapper, Jack fish, Barracuda, Macromonvertebrates.

Samples of fish and crustaceans (shrimp, crabs, and others) were collected by net and by hook and line from the Gulf of Mexico and the Caribbean Sea for analysis of residues of DDT, DDE, and PCB. Samples were put in mason jars and frozen until analysis by gas chromatography. Fish and crustaceans were analyzed whole except when fish muscles and organs were removed for separate analysis. Recoveries were 85 percent or better with spiked samples, and detection limits ranged from 0.1 to 0.3 micrograms per kg wet weight for DDT and DDE and 1 to 3 micrograms per kg for PCB's. All three compounds were found widely distributed in all biota; however, samples from coastal areas generally had higher levels than samples from open waters. The ratio of DDE to DDT varied widely between samples. Livers from larger fish generally contained higher levels of DDE than DDT, possibly indicating the capability of this organ to metabolize DDT. Fish liver usually had the highest concentration of all three compounds and muscle tissue the lowest. (Little-Battelle)

PROGRESS REPORT ON WATER QUALITY OF LAKE MICHIGAN NEAR CHICAGO,

Chicago Dept. of Water and Sewers, Ill.

J. C. Vaughn, and P. A. Reed.

Water and Sewage Works, Vol 120, No 5, p 73-80, May 1973. 5 fig, 13 tab, 1 ref.

Descriptors: *Water quality, *Water quality standards, *Lake Michigan, *Surveys, Water pollution, Bioindicators, Illinois, Water policy, Water properties, Odor, Coliforms, Bacteria, Activated carbon, Color, Water temperature, Hydrogen ion concentration, Iron, Dissolved oxygen, Ammonia, Nitrogen, Chlorides, Fluorides, Phenols, Sulfates, Phosphates, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Manganese, Nickel, Nitrates, Oil, Zinc, Phosphorus, Dissolved solids, Water sampling, Heavy metals, Organic compounds, Halides.

Identifiers: Chemical indicators, Hydrocarbons, Fecal streptococci, Fecal coliforms, Methylenedioxime active substance, Cyanides, Filterable residues, Arsenic, Barium, Carbon tetrachloride extract, Selenium, Silver.

Data are presented primarily from the South Water Filtration Plant (SWFP) operation and test information on various water quality parameters of Lake Michigan near Chicago. These data were compared to the Illinois Pollution Control Board (IPCB) standards. The comparisons with the IPCB standards lead, not surprisingly, to the same general conclusions as those based on the repealed regulation SWB-7. One may tentatively conclude that relatively little sewage plant effluent is entering the lake in the area of interest. The data do not permit exact analysis or differentiation but the principal sources of pollution appear to be industrial wastes and possibly runoff. The spotty pattern of changes in concentration, with improvement in some respects (coliform, phenol, and ammonia nitrogen, as examples) and deterioration in others, also suggests that the most useful method of further investigation would concentrate on investigation of specific possible sources. Any other approach would probably be out of date and inappropriate. (Holoman-Battelle)
W73-11581

NUTRIENT RATIO VARIATION IN RESERVOIR SEDIMENTS,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.

A. C. Hendricks, and J. K. G. Silver.

Journal Water Pollution Control Federation, Vol 45, No 3, p 490-497, March 1973. 5 fig, 2 tab, 18 ref.

Descriptors: *Nutrients, *Sediments, *Variability, Reservoirs, Aquatic soils, Soil analysis, Chemical analysis, Carbon, Texas, Sampling, Phosphates, Bottom sediments, Nitrogen, Nitrates, Hypolimnia.

Identifiers: *Garza-Little Elm Reservoir, Organic carbon, Kjeldahl nitrogen, Heterotrophy, Enrichment, Sample preparation.

Chemical analyses were performed on a number of sediment samples collected from two sections of Garza-Little Elm reservoir, near Dallas, Texas. These analyses consisted of ash-free weights, organic carbon, Kjeldahl nitrogen, phosphates, and nitrates. The results indicated that the area richest in nutrients was in deep water where a hypolimnia existed in the summer. Cove areas were about equal in enrichment whether or not marinas were located on them. Areas along the shores demonstrated least enrichment. (Holoman-Battelle)
W73-11591

PHOSPHORUS IN WASTE WATER,

New York State Dept. of Environmental Conservation, Albany. Research and Development Unit.

For primary bibliographic entry see Field 05D.

W73-11592

PESTICIDE DEGRADATION BY MARINE ALGAE,

Wisconsin Univ., Madison. Dept. of Entomology.

G. M. Boush, and F. Matsumura.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

Available from the National Technical Information Service as AD-754 841, Report No. 1, February 1, 1973, 7 p, 2 tab, 8 ref. Contract No. N00014-67-A-1028-0023.

Descriptors: *Marine algae, *Pesticides, Degradation (Decomposition), DDT, Methodology, Chlorophyta, Diatoms, Systematics, Radioactivity techniques, 2-4-D, 2,4,5-T, Plant growth, Marine plants, Plant morphology, Biodegradation, Carbon radioisotopes, Chrysophyta, Water pollution, Phytoplankton, Chlorinated hydrocarbon pesticides, Insecticides, Path of pollutants.

Identifiers: *Pure cultures, Fate of pollutants, Metabolites, Thin layer chromatography, Autoradiography, C-14, Porphyridium, Cyclotella nana, Nannochloris, Chaetoceros galvestonensis, Neochloris, Amphidinium carteri, Dunaliella tertiolecta, Neochloris, Tetraselmis, Agmenellum quadruplicatum, Rhodomonas torula, Coccolithus clavans, Oscillatoria williamsii, Isochrysis galbana, Phaeodactylum tricornutum.

A collection has been developed of marine algae representative of the major groups in pure culture. An improved technique has been developed to effectively survey algae for potential degradative ability with reference to pesticides. The pesticide is added to the algal cultures in the log, or active growth phase. The cultures are then analyzed for metabolites after a 7-day incubation period. Such a procedure allows for a minimum possibility of pesticide inhibition of growth. All pesticides were C-14-labeled and degradation products were examined by comparative TLC and autoradiography. Marine algae, in general, appeared to be influenced by low levels (ppb range) of many pesticides adversely. Pesticide degradation abilities appeared less than those encountered with bacteria. (Holoman-Battelle)

W73-11601

STUDY OF THE RESPIRATION AND THE NITROGEN AND PHOSPHORUS EXCRETION OF ZOOPLANKTONIC POPULATIONS OF THE MAURITANIAN UPWELLING, (MARCH-APRIL 1972). (ETUDE DE LA RESPIRATION ET DE L'EXCRETION D'AZOTE ET DE PHOSPHORE DES POPULATIONS ZOOPLANCTONIQUES DE L'UPWELLING MAURITANIE (MARS-APRIL 1972),

Office de la Recherche Scientifique et Technique Outre-Mer, Abidjan (Ivory Coast). Centre de Recherches Oceanographiques.

R. P. LeBorgne.
Marine Biology, Vol 19, No 3, p 249-257, April 1973. 9 fig, 4 tab, 29 ref.

Descriptors: *Nitrogen, *Phosphorus, *Respiration, *Zooplankton, Nutrients, Marine animals, Sea water, Cycling nutrients, Mathematical studies, Equations, Estimating, Animal metabolism, Phosphates, Animal populations, Carbohydrates, Lipids.

Identifiers: *Excretion, Nutrient flux, Ammonium, Mauritanian upwelling, Correlation coefficients, Organic phosphorus, Catabolism.

Fifty-six experiments were run for 22 h on 200-micron-net zooplankton in non-filtered sea water. The equations of orthogonal regression lines between respiration, and mineral, total nitrogen, and phosphorus excretion rates have been computed for 14 stations in the upwelling Mauritanian area. Correlation coefficients are high: excretion values may be estimated from respiration values in order to follow the N and P flux through the Mauritanian zooplankton populations. O:N, O:P, N:P, mineral: total excretion ratios are calculated for each station and are not significantly different in the 3 areas of the upwelling area studied. On the average, 48 percent of excreted phosphorus is thoroughly oxidized into phosphate and needs 142.4 atoms in respiration per P atom. The remainder, excreted as organic phosphorus, requires the same amount of oxygen for its later

mineralization. The O:P ratio thus obtained is close to the theoretical - 276. Fifty four percent of the nitrogen excreted is mineral and the O:N-NH₄ (plus) ratio shows a dominant carbohydrate and fat catabolism. The N:P ratio is constant, and close to 10 for both mineral and total excretion. (Holoman-Battelle)

W73-11603

DISPERSED AND PARTICULATE PETROLEUM RESIDUES IN THE GULF OF ST. LAWRENCE, Bedford Inst., Dartmouth (Nova Scotia).

E. M. Levy, and A. Walton.
Journal of the Fisheries Research Board of Canada, Vol 30, No 2, p 261-267, February 1973, 3 fig, 13 ref.

Descriptors: *Water pollution sources, *Oil pollution, *Oily water, *Distribution, *Sea water, Pollutant identification, Chemical analysis, Water pollution, Oil, Water sampling, Solvent extraction, Path of pollutants, Water analysis, Methodology.

Identifiers: *Gulf of St. Lawrence, *Petroleum residues, Fluorescence spectrophotometry, Sample preparation.

Concentrations of petroleum residues both as material in solution or dispersed through the water column and as fresh oily particles floating on the surface in the Gulf of St. Lawrence were measured during July-August 1971. Niskin samplers were used to collect water samples for dissolved and dispersed oil determinations from varying depths at stations 1.9, 7.6, and 18.5 km from the site of a sunken barge. CC14 extracts were analyzed by fluorescence spectrophotometry. The sea surface was sampled by towing a modified neutron sampler for one nautical mile at 5-7 knots. The sample was frozen for later processing and fresh oil was removed from the net with CC14. Dissolved and dispersed forms were present in concentrations generally less than 5 ppb over the southern and western regions while 5-10 ppb were encountered in the north and east. A major source of these residues appears to be the Atlantic water that enters through Cabot Strait, and the distribution of these materials is closely related to the circulation of water within the Gulf. Surface oil was present at approximately 50 percent of the stations occupied in concentrations generally less than 100 micrograms/m³ but as great as 12,400 micrograms/m³ in the vicinity of the sunken barge Whale. There is no evidence to indicate an appreciable change in concentrations to those of a year ago. (Holoman-Battelle)

W73-11612

NITROGEN AND PHOSPHORUS UPTAKE BY CHLORELLA PYRENOIDOSA IN SEWAGE TREATMENT PROCESSES,

Harvard Coll., Cambridge, Mass.

T. M. Michel, and J. L. Michel.

Water and Sewage Works, Vol 120, No 3, p 76-79, March 1973. 3 fig, 21 ref.

Descriptors: *Nitrogen, *Phosphorus, *Nutrient removal, *Sewage effluents, *Sewage treatment, *Absorption, *Domestic wastes, Cultures, Chemical analysis, Aquatic algae, Chlorophyta, Nutrients, Nitrates, Nitrites, Chlorophyll, Suspended solids, Biochemical oxygen demand, Coliforms, Hydrogen ion concentration, Dissolved oxygen, Chemical oxygen demand, Photosynthesis, Temperature, Ammonia, Biomass, Eutrophication.

Identifiers: *Chlorella pyrenoidosa, *Assimilation, Scenedesmus acutus, Substrate utilization, Quantitative analysis, Fecal coliforms, Organic nitrogen, Kjeldahl nitrogen, Organic phosphorus.

The alga, Chlorella pyrenoidosa, was grown using the primary effluent of a domestic sewage treatment plant as a nutrient base and studied specifically

for its ability to utilize the nitrogen and phosphorus forms present in the secondary stages of wastewater treatment. To study N and P assimilation, a controlled system in a batch culture format was set up which included a method for continuous monitoring of DO, pH and culture temperature. Samples of primary effluent were analyzed for basic nutrient data and then placed in the culture vessels. Tests were conducted for between 48 and 168 hours on the metabolic behavior of the algae and on the patterns of nutrient assimilation. All soluble, precipitate and total forms of organic and inorganic P were measured, and quantitative analyses of total Kjeldahl N, organic N and NH₃ were made. Culture samples were analyzed for coliform organisms, cell count and mass, chlorophyll, NO₂, NO₃, suspended solids, BOD, COD, DO, and pH. Photosynthetic activity was determined by evaluating DO concentrations. About 50 percent of all P forms present in the primary effluent were removed by Chlorella. Media pH rose during the initial bloom periods but tended to stabilize over the entire run. During an experimental run period there was a significant drop in the number of fecal and total coliform group organisms present. N uptake closely paralleled the rate of biosynthetic activity and over 80 percent of the N forms present were removed. Experimentation showed that growth and nutrient assimilation rates for Chlorella pyrenoidosa far exceed those of the strain of Scenedesmus acutus isolated from the sewage samples. (Holoman-Battelle)

W73-11617

PESTICIDES IN WATER,

Brigham Young Univ., Provo, Utah. Dept. of Chemistry.

J. S. Bradshaw, E. L. Loveridge, K. P. Rippee, J. L. Peterson, and D. A. White.

Pesticides Monitoring Journal, Vol 6, No 3, p 166-170, December 1972. 2 fig, 1 tab, 13 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Pesticide residues, *Freshwater fish, *Chemical analysis, *Water analysis, *Water pollution sources, Insecticides, Water sampling, Channel catfish, Carp, White bass, Path of pollutants, Utah, Dieldrin, DDT, DDE, Aldrin, Heptachlor, Bullheads, Catfishes.

Identifiers: *Utah Lake, *Seasonal variation, Sample preparation, Electron capture gas chromatography, Gas liquid chromatography, Black bullhead, Methoxychlor, Heptachlor epoxide, Lindane, Alpha-BHC, Cyprinus carpio, Ictalurus punctatus, Ictalurus melas, Morone chrysops, Roccus chrysops, Bioaccumulation, Animal tissues.

Gallon-water samples were taken from 15 tributaries and 1 outlet point of Utah Lake biweekly from March 1 - July 1, 1970, and weekly or semiweekly through February 1971. The samples were extracted as soon as possible (within 3 days) with nanograde petroleum ether in a continuous liquid-liquid extractor for 24 hours. The ether extract was dried, filtered, evaporated to 10 ml, and analyzed for pesticide residues by electron capture gas chromatography. Fish caught in the lake were analyzed by gas-liquid chromatography. The water samples were found to contain aldrin, alpha-BHC, gamma-BHC, heptachlor, heptachlor epoxide, methoxychlor, DDT, and DDE. DDE, dieldrin, methoxychlor, DDT, and BHC were found in the fish analyzed, with DDE being the most common. The smaller and younger fish contained lesser amounts of DDE. Definite surges of pesticides (1 ppb or more) were shown to enter Utah Lake three times per year - early spring, late spring, and fall, generally corresponding to the application times of pesticides by farmers in the area. The pesticides involved were mainly aldrin and BHC in the early spring; heptachlor (plus heptachlor epoxide) and methoxychlor in the late spring; and aldrin, heptachlor and methoxychlor in the late fall. (Holoman-Battelle)

W73-11618

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources of Pollution

ORGANOCHLORINE INSECTICIDES IN SURFACE WATERS IN GERMANY-1970 AND 1971. Bundesgesundheitsamt, Berlin (West Germany). For primary bibliographic entry see Field 05C. W73-11628

SPRING PHYTOPLANKTON ABUNDANCE AND PRODUCTIVITY IN GRAND TRAVERSE BAY, LAKE MICHIGAN, 1970. Michigan Univ., Ann Arbor. Great Lakes Research Div. E. F. Stoermer, C. L. Schelske, M. A. Santiago, and L. E. Feldt. Available from the National Technical Information Service as COO-2003-14. Report, April 1972. 20 p, 1 fig, 3 tab, 18 ref. Grant No. GA-4507.

Descriptors: *Standing crops, *Primary productivity, *Phytoplankton, *Diatoms, Water sampling, Turbidity, Nitrates, Silica, Phosphorus, Aquatic algae, Seasonal, Dominant organisms, Photosynthesis, Nansen bottles, Secchi disks, Chemical properties, Depth, Chrysophyta, Protozoa, Spring, Lake Michigan.

Identifiers: *Species diversity, *Grand Traverse Bay, Particulate matter, Stephanodiscus spp, Diatoms spp, Cyclotella spp, Fragilaria spp, Synedra filiformis, Flagellates, Rhizosolenia spp, Tabellaria fenestrata, Melosira spp, Asterionella formosa.

Water samples were taken from twelve stations in Grand Traverse Bay using a Nansen bottle cast on May 20, 1970, at 5 m and June 18, 1970, at depths of 5 m from the surface and 1 m above the bottom. Secchi disc transparencies, particulate P, nitrate, silica and carbon fixation rates were measured. Phytoplankton cell number and species composition were determined microscopically. In May 1970, the phytoplankton abundance (standing crop) ranged from 1455 to 3355 cells/ml and increased significantly in June from 2500 to 6469 cells/ml. The same populations dominated the assemblages at all stations and estimated diversity of assemblages was relatively high and uniform, ranging from 2.3 to 2.6 in May to 1.8 - 2.2 in June. Estimates of primary productivity in May from the same stations ranged from 3.8 mg C/cu m/hr to 9.1 mg C/cu m hr and followed the same general pattern of areal distribution as the standing crop estimates. Estimates of primary productivity were more variable during the June sampling period, with values ranging from 2.7 mg C/cu m hr to 13.4 mg C/cu m hr, with greatest differences again being between most productive stations in the lower west arm and least productive stations in the upper east arm. (Holoman-Battelle) W73-11629

THE BACTERIOLOGY OF THE WATER SUPPLIES OF RANGOON: II. COOL DRY AND HOT DRY SEASONS. Institute of Medicine (I), Rangoon (Burma). Dept. of Microbiology. For primary bibliographic entry see Field 05C. W73-11630

POLLUTION EFFECTS ON PHYCOVIRUS AND HOST ALGAE ECOLOGY. Delaware Univ., Newark. Dept. of Biological Sciences. For primary bibliographic entry see Field 05C. W73-11635

THE ROLE OF NITROGEN IN THE AQUATIC ENVIRONMENT. Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology. For primary bibliographic entry see Field 05C. W73-11640

CYCLING OF ELEMENTS OF ESTUARIES. National Marine Fisheries Service, Beaufort, N.C. Atlantic Estuarine Fisheries Center.

D. A. Wolfe, and T. R. Rice. Fishery Bulletin, Vol 70, No 3, p 959-972, 1972. 3 tab, 47 ref.

Descriptors: *Model studies, *Heavy metals, *Estuaries, *Marine animals, Reviews, Sediments, Path of pollutants, Estuarine environment, Calcium, Mathematical models, Titanium, Magnesium, Potassium, Sodium, Cobalt, Copper, Iron, Manganese, Zinc, Aluminum, Molybdenum, Cesium, Chromium, Nickel, Strontium, Beryllium, Cadmium, Lead, Mercury, Adsorption, Ion exchange, Sedimentation, Suspension, Crabs, Clams, Benthos, Zooplankton, Oysters, Diatoms, Phytoplankton, Fish, Scallops, Shrimp, Snails, Rain, Runoff, Distribution, Salinity, Solar radiation, Suspended solids.

Identifiers: *Biotransformation, *Transport, *Bioaccumulation, Scandium, Vanadium, Silicon, Tin, Rubidium, Antimony, Arsenic, Barium, Bismuth, Selenium, Silver, Thorium, Cycling, Polychaetes, Asterionella japonica, Atlantic menhaden, Striped mullet, Bay anchovy, Blue crab, Atlantic silverfish, Atlantic croaker, Spot, Pinfish, Flounder, Bluefish, Spotted seatrout, Weakfish, Biological magnification.

Review and discussions are presented on the types of information needed to develop useful models for the cycling of contaminant metals (both radioactive and stable) in estuarine ecosystems. Basic requirements are knowledge of the major reservoirs of the metals, which in most cases are the sediment and water, the mechanisms and pathways of elemental transformation, rates of elemental turnover among reservoirs, and responses of these processes and reservoirs to environmental change. A conceptual systems model is presented as the preliminary phase in the development of dynamic mathematical models of elemental cycling. (Little-Battelle) W73-11645

THE NEED FOR HYDROGEOLOGIC EVALUATIONS IN A MINE DRAINAGE ABATEMENT PROGRAM: A CASE STUDY, TOMS RUN, CLARION COUNTY, PENNSYLVANIA. Pennsylvania Dept. of Health, Harrisburg. Bureau of Sanitary Engineering. For primary bibliographic entry see Field 05G. W73-11674

INFLUENCE OF AGRICULTURAL PRACTICES ON WATER QUALITY IN NEBRASKA: A SURVEY OF STREAMS, GROUNDWATER, AND PRECIPITATION. Nebraska Univ., Lincoln. Dept. of Agronomy. R. A. Olson, E. C. Seim, and J. Muir. Water Resources Bulletin, Vol 9, No 2, p 301-311, April 1973. 3 fig, 2 tab, 11 ref. OWRR B-004-NEB (3).

Descriptors: *Water pollution sources, *Nebraska, *Fertilizers, *Irrigation practices, Farm wastes, Path of pollutants, Water quality, Nitrates, Phosphates, Nutrients, Water pollution effects, Groundwater, Surface waters.

Where nutrient levels of streams in Nebraska are elevated, the cause is usually industrial, sewage or livestock waste intrusion, and not crop production practices. The only significant quantity of nutrient N and P induced by cultivation is that accompanying sediments from eroded fields. The P content of Nebraska groundwater has remained essentially constant during the past 10 years while average NO₃ has increased slightly, in a period during which farmer fertilizer use quadrupled. During the same time, irrigation acreage has increased by 50%, livestock numbers by 30%, with corresponding growth in human population and attendant industries. Irrigation practice has contributed more than any other factor to the small increase in groundwater NO₃. (Knapp@USGS) W73-11696

5C. Effects of Pollution

COMPUTER SIMULATION OF EUTROPHICATION. Oregon State Univ., Corvallis. Dept. of Civil Engineering. D. A. Bell. Available from the National Technical Information Service as PB-221 328, \$3.00 in paper copy, \$0.95 in microfiche. Final Report, (1973). 14 p, 11 ref. OWRR-C-1819 (3172) (2). 14-31-0001-3172.

Descriptors: *Computer models, *Eutrophication, Lake stages, Mixing, *Oregon, Simulation analysis, Mathematical models, *Dissolved oxygen, Hypolimnia, Oxygenation, Reaeration, Water temperature.

Identifiers: *Triangle Lake (Oregon).

A mathematical model describing the DO variations in a stratified lake was developed. The basic model was one-dimensional including DO variations with depth and time. The model describes the combined effect of photosynthesis, reaeration, vertical mixing and total respiration. A method of using the model to determine hypolimnetic oxygen uptake rates was presented. The model study indicated that the DO concentrations within the hypolimnetic waters of lakes were more sensitive to vertical mixing and total respiration than to photosynthetic oxygenation or reaeration. A companion field study on an eutrophic lake was partially supported by this project in order to better relate actual field results to the capabilities and limitations of the model. The temporal and spatial variations of temperature and dissolved oxygen were measured in Triangle Lake, Oregon. The lake was found to be relatively uniform in the horizontal direction and significantly vertically stratified. W73-11651

PLANT ANALYSIS FOR NUTRIENT ASSAY OF NATURAL WATERS. Wisconsin Univ., Madison. Dept. of Botany; and Wisconsin Univ., Madison. Inst. of Plant Development. G. C. Gerloff.

Copy available from GPO Sup Doc as EP1.23(4)-73-001, \$0.95; microfiche from NTIS as PB-221 332, \$0.95. Environmental Protection Agency, Health Effects Research Series Report EPA-R1-73-001, February 1973. 66 p, 5 fig, 16 tab, 26 ref. EPA Project 18040 DGI.

Descriptors: *Nutrient requirements, Deficient elements, Minerals, *Eutrophication, Aquatic weeds, *Bioassay, Fertility, *Wisconsin Lakes. Identifiers: *Macrophytes, *Elodea occidentalis, *Ceratophyllum demersum.

Plant analysis has been developed as a procedure for evaluating nutrient supplies and growth-limiting nutrients for nuisance macrophytes in lakes and streams. Plant analysis is based on establishing in index segments the critical concentration (minimum plant concentration for maximum yield) of each essential nutrient element likely to limit growth of nuisance macrophytes. Critical concentrations for nitrogen, phosphorus, sulfur, calcium, magnesium, potassium, iron, manganese, zinc, boron, and molybdenum were established in appropriate index segments of Elodea occidentalis. The critical copper concentration was estimated. Critical concentrations for several elements also were established in Ceratophyllum demersum. To evaluate plant analysis as an assay procedure, index segments of Elodea and Ceratophyllum were routinely collected from Wisconsin lakes, analyzed, and the analyses were compared with the critical concentrations for indications of nutrient deficiency. Nitrogen, Phosphorus, Calcium, and copper were at or close to critical levels in one or more lakes. Neither nitrogen nor phosphorus seemed to be a general growth-limiting nutrient in the lakes sampled. (EPA) W73-11057

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

AN IN SITU EVALUATION OF NUTRIENT EFFECTS IN LAKES,

Virginia Inst. of Marine Science, Gloucester Point,
R. A. Jordan, and M. E. Bender.

Copy available from GPO Sup Doc as EP1.23:73-018, \$2.60; microfiche from NTIS as PB-221 341, \$0.95. Environmental Protection Agency, Ecological Research Series Report EPA-R3-73-018, April 1973. 227 p, 45 fig, 30 tab, EPA Project 16010 HIU.

Descriptors: *Eutrophication, *Nutrients, *Phytoplankton, Primary productivity, Nitrogen, Phosphorus, Chelation, Lakes, *On-site investigations, Sewage effluent.

Identifiers: *Enrichment experiments, Factorial designs, Individual species responses.

A method for performing in situ nutrient enrichment experiments on natural lake phytoplankton communities was developed and evaluated. One set of experiments in which it was employed was designed to detect limiting nutrients and to provide a basis for predicting future experiment results. Productivity increased in response to all three of the treatment variables used, N, P, and EDTA, but response patterns varied from experiment to experiment. Individual species responded differently to different treatments, and interactions among the treatment variables were important in shaping the community responses to mixtures of two or three variables. The most consistent features of the productivity results were incorporated into a 'most probable response pattern,' which was partially validated by a second series of experiments. The second experiment series was also used to test the ability of NTA to stimulate phytoplankton productivity. Stimulation was continually obtained. In a third series of experiments sewage effluents were tested in parallel with N and P. Varying degrees of overlap between the species complexes responding to the sewage and to the N and P treatments were found. Recommendations for the use of in situ enrichment experiments in eutrophication studies are presented. (EPA)

W73-11070

PHOSPHORUS RELEASE FROM LAKE SEDIMENTS,

Battelle-Pacific Northwest Labs., Richland, Wash.

R. E. Wildung, and R. L. Schmidt.

Copy available from GPO Sup Doc as EP1.23 73 024, \$2.00; microfiche from NTIS as PB-221 342, \$0.95. Environmental Protection Agency, Ecological Research Series Report EPA-R3-73-024, April 1973. 185p, 35 fig, 74 tab, 81 ref. EPA Project 16010 DUA 14-12-508.

Descriptors: *Water quality, *Eutrophication, *Phosphorus, Inorganic compounds, Organic compounds, *Sediments, Algae, Carbon, Nitrogen, Sediment-water interfaces, Mineralogy, Lake Erie, *Lake sediments, *Oregon, Minnesota. Identifiers: Upper Klamath Lake (Ore), *Agency Lake (Ore), *Diamond Lake (Ore), Shagawa Lake (Minn).

Investigations were undertaken to characterize the major inorganic and organic forms of phosphorus in sediments of Upper Klamath Lake, Oregon, determine the potential for release of phosphorus from the sediment as influenced by water and sediment composition and environmental parameters, and establish the relationship between phosphorus release and algal growth. Sediment characterization was extended to other lake systems including Shagawa Lake in Minnesota, Agency and Diamond Lakes in Oregon and Lake Erie. Sediments of Upper Klamath Lake, although differing in their ability to release phosphorus, exhibited seasonal changes in phosphorus concentration. These changes were most pronounced in the inorganic phosphorus fraction and in a bay which received agricultural runoff and initially contained relatively large quantities of phosphorus in the sediment interstitial water. Release of and resorp-

tion of phosphorus associated with the solid phase occurred. Release appeared to be largely from non-occluded iron forms of phosphorus whereas resorption was primarily in the form of non-occluded aluminum forms of phosphorus. The rate and extent of phosphorus release, described by regression models, was related to sediment composition. Release was accelerated by increased temperature and the presence of a phosphorus sink such as an anion exchange resin in laboratory studies or actively reproducing phytoplankton in field studies. Algal growth response to phosphorus released from sediments during dialysis was approximately equivalent to the response to orthophosphate. (EPA) W73-11072

EFFECTS OF CHEMICAL VARIATIONS IN AQUATIC ENVIRONMENTS: VOLUME I, BIOTA AND CHEMISTRY OF PICEANCE CREEK,

Colorado State Univ., Fort Collins. Dept. of Fishery and Wildlife Biology.

W. H. Everhart, and B. E. May.

Copy available from GPO Sup Doc as EP1.23 73-011a, \$2.10; microfiche from NTIS as PB-221 343, \$0.95. Environmental Protection Agency, Ecological Research Series Report EPA-R3-73-011a, February 1973. EPA Project 18050-DYC.

Descriptors: *Aquatic insects, Oligochaetes, Gastropods, Amphipods, Leeches, Water properties, *Colorado, Water chemistry, *Invertebrates, *Biota.

Identifiers: Stream fauna, *Oil shale (Colorado), Piceance Creek (Colo).

Sampling a small stream in the rich oil shale country of northwestern Colorado confirmed distinct seasonal trends and habitat preference in invertebrate populations. Discharge was a major influence on invertebrates and chemical composition of the stream. Seasonal variations, biomass, and species composition of invertebrates appear characteristic of oil shale area streams. (See also W73-11075 and W73-11076) (EPA) W73-11074

EFFECTS OF CHEMICAL VARIATIONS IN AQUATIC ENVIRONMENTS: VOLUME II, TOXIC EFFECTS OF AQUEOUS ALUMINUM TO RAINBOW TROUT,

Colorado State Univ., Fort Collins. Dept. of Fishery and Wildlife Biology.

W. H. Everhart, and R. A. Freeman.

Copy available from GPO Sup Doc as EP1.23:73-011b, \$0.75; microfiche from NTIS as PB-221 344, \$0.95. Environmental Protection Agency, Ecological Research Series Report number, EPA-R3-73-011b, February 1973. 41 p, 8 fig, 5 tab, 22 ref. EPA Project 18050-DYC.

Descriptors: *Rainbow trout, *Aluminum, *Toxicity, Hydrogen ion concentration, Aqueous solutions, Aquatic environment, Lethal limit, Water pollution effects.

Fertilized eggs, fry, and fingerlings were exposed to aqueous aluminum complexes in neutral and basic media under constantly flowing, controlled conditions of aluminum concentration, pH, and temperature. Toxicities of various concentrations were highly pH dependent. Dissolved concentrations over 1.5 ppm aluminum caused physiological and behavioral aberrations as well as acute mortality. Toxic effects of suspended aluminum, though greater at lower concentrations, do not increase as much as the effects of dissolved aluminum with higher concentrations. Growth of trout exposed to high dosages of aluminum was reduced only as long as or slightly longer than the exposure continued. Egg and fry bioassays were conducted with exposures in trays and simulated natural redds. Fertilization was not affected by any concentrations tested, and most mortalities

occurred during hatching and in the post-swim-up stage. Trends in toxicity were similar to those found with fingerlings indicating dissolved aluminum to be more toxic than equivalent suspended amounts. (See also W73-11074 and W73-11076) (EPA) W73-11075

EFFECTS OF CHEMICAL VARIATIONS IN AQUATIC ENVIRONMENTS: VOLUME III, LEAD TOXICITY TO RAINBOW TROUT AND TESTING APPLICATION FACTOR CONCEPT,

Colorado State Univ., Fort Collins. Dept. of Fishery and Wildlife Biology.

P. H. Davies, and W. H. Everhart.

Copy available from GPO Sup Doc as EP1.23:73-011c, \$1.25; microfiche from NTIS as PB-221 345, \$0.95. Environmental Protection Agency, Ecological Research Series Report, EPA-R3-73-011c, February 1973. 80 p, 14 fig, 21 tab, 60 ref. EPA Project 18050-DYC.

Descriptors: *Rainbow trout, *Lead, *Toxicity, *Bioassay, Water pollution effects, Aquatic environment, Lethal limit, *Assay, Analytical techniques.

Identifiers: Application factor.

Four chronic bioassays were conducted to determine the toxicity of lead to rainbow trout. Results obtained from acute and chronic bioassays in hard water (alkalinity 243.1 mg/liter) and soft water (alkalinity 26.4 mg/liter) were used to test the application factor approach as related to different water qualities. The toxicity of lead to rainbow trout in hard water was determined on a total and dissolved lead basis. The 96-hr TL50 and 'MATIC' on a total lead basis were 471 mg/liter and 0.12 to 0.36 mg/liter respectively, which yielded an application factor of .0002 to .0008. Analysis of the free or dissolved lead gave a 96-hr TL50 of 1.38 mg/liter and a 'MATIC' of 0.018 to 0.032 mg/liter, resulting in an application factor of .0130 to .0232. Total and free lead were considered to be the same in soft water. The 18-day TL50 and 'MATIC' obtained from the soft water bioassays were 140 micrograms/liter and 6.0 to 11.9 micrograms/liter lead respectively. Computations using the TL50 and 'MATIC' values gave a soft water application factor of .0429 to .0850. The maximum acceptable toxicant concentration ('MATIC') was determined in both hard and soft water bioassays on the occurrence of abnormal black tails caused by chronic lead exposure. The application factor approach as related to different water qualities was found to be very promising when lead analysis was limited to the free or dissolved metal and failed when total hard water lead concentrations were used. (See also W73-11074 and W73-11075) (EPA) W73-11076

POLLUTION AS A RESULT OF FISH CULTURAL ACTIVITIES,

Utah State Div. of Wildlife Resources, Salt Lake City.

For primary bibliographic entry see Field 05B.

W73-11077

ANALYSIS OF ENGINEERING ALTERNATIVES FOR ENVIRONMENTAL PROTECTION FROM THERMAL DISCHARGES,

Washington State Water Research Center, Pullman.

For primary bibliographic entry see Field 05G.

W73-11078

WATER QUALITY INVESTIGATIONS: SOURIS RIVER BASIN, NORTH DAKOTA, 1969,

Environmental Protection Agency, Kansas City, Mo. Region VII.

For primary bibliographic entry see Field 05B.

W73-11115

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

DETERMINATION OF MERCURY CONTENTS IN DIVERSE SAMPLES OF FISH AND OTHER BIOLOGICAL MATERIALS BY NEUTRON ACTIVATION ANALYSIS, (NEUTRONENAKTIVIERUNGSANALYTISCHE BESTIMMUNGEN VON QUECKSILBERGEHALTEN IN DIVERSEN FISCHPROBEN UND A NDREN BIOLOGISCHEN MATERIALEN),
Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Radiochemie.
For primary bibliographic entry see Field 05A.
W73-11123

APPLICATION OF THE FLUORESCENT ANTIBODY TECHNIQUE TO THE DIFFERENTIATION OF ASPERGILLUS SPECIES, CANDIDA SPECIES AND ZYgomycetes IN PARAFFIN SECTION OF FORMALIN-FIXED TISSUES, North Carolina Univ., Chapel Hill.
For primary bibliographic entry see Field 05A.
W73-11126

STUDY OF THE CHANGES IN THE STRUCTURE OF TWO ALgal POPULATIONS: AN R- TYPE FACTOR ANALYSIS, Louvain Univ. (Belgium). Institut Carnoy.
For primary bibliographic entry see Field 05A.
W73-11129

PARTITIONING OF A BRACKISH WATER HABITAT BY COPEPOD SPECIES, Ghent (Belgium). Dept. of Zoology Rijksuniversiteit.
For primary bibliographic entry see Field 05A.
W73-11130

ECOLOGY OF YELLOWSTONE THERMAL EFFLUENT SYSTEMS: INTERSECTS OF BLUE- GREEN ALGAE, GRAZING FLIES (PARACOENIA, EPHYDRIDAE) AND WATER MITES (PARTNUELIA, HYDRACHNELLAE), Georgia Univ., Athens. Dept. of Zoology. R. G. Wiegert, and R. Mitchell. Hydrobiologia, Vol 41, No 2, p 251-271, March 29, 1973. 3 fig, 6 tab, 12 ref.

Descriptors: "Hot springs, Ecosystems, "Aquatic bacteria, "Aquatic algae, Biological communities, "Succession, Ecology, Trophic level, Parasitism, Predation, Stability, Thermal springs, Life cycles, Water temperature, Biomass, Diptera, Alkaline water, Aquatic productivity, Growth stages, Larvae, Effluents.
Identifiers: "Arthropods, "Population dynamics, Species interaction, "Water mites, Partnunella thermalis, Paracoenia turbida, Ephydra, Lamproscatella, Urolepis, Spiders, Brine fly, Synchococcus, Species density, "Yellowstone National Park.

Studies of succession, population dynamics and species intersects of alkaline hot spring effluent communities in the Lower Geyser Basin of Yellowstone National Park have been used to define the 3 basic elements in the biological interactions of the characteristic algal-bacterial-arthropod ecosystems. The 3 major biotic elements in these communities were (1) an algal mat comprising several species of filamentous blue-green algae, (2) a primary biophage, the brine fly Paracoenia turbida, which feeds on the algal mat as both larva and adult, and (3) a red water mite, Partnunella thermalis, whose larvae are parasitic on adult Paracoenia. Additional animals are found in this simple community; some other genera of brine fly (Ephydra, Lamproscatella), a parasitic wasp (Pteromalidae, Urolepis), and lycosid spiders are present throughout their life cycle. Other species are important components of the system (i.e. the predaceous dolichopodid flies), but they spend only part of their life cycle in or on the mat. The dominant primary producers were grazed by ephydrid flies. These in turn harbored larvae of the water mite Partnunella. The high intrinsic rate of in-

crease of the fly enabled it to exploit temporary cool spots in the mat. The lower fecundity and longer life cycle of the mite restricted its ability to exploit temporarily suitable habitat. Thus the intersect of mites with flies is a sensitive measure of stability in the algal mat. Springs with a variable-flow pattern and consequent mat instability had both a lower mean incidence of parasitism and a lower mean larval load per fly. The data support the hypothesis that the abundance and relative densities of organisms in higher trophic levels can be predicted from knowledge of the growth and stability patterns of the filamentous blue-green algal mat in thermal spring effluents. (Holomant-Battelle)
W73-11131

ENUMERATION AND DIFFERENTIATION OF WATER BACTERIA WITH PHOSPHORUS-32, Roorkee Univ. (India).
For primary bibliographic entry see Field 05A.
W73-11133

ISOLATION OF SALMONELLA FROM MODERATELY POLLUTED WATERS, Department of the Environment, Burlington (Ontario). Centre for Inland Waters.
For primary bibliographic entry see Field 05A.
W73-11134

WATER QUALITY MODELS FOR TOTAL COLIFORM, Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W73-11135

INFANT MORTALITY AND HARDNESS OF LOCAL WATER SUPPLIES, Medical Research Council, London (England). Social Medicine Unit. M. D. Crawford, M. J. Gardner, and P. A. Sedgwick. Lancet (North Am Ed). Vol 1, No 7758, p 988-992, 1972. Illus.
Identifiers: Calcium, "England, "Infant mortality, "Wales, "Water hardness.

In the large county boroughs of England and Wales the softer the drinking-water and the less Ca it contains, the higher the infant death rate. A multiple regression study demonstrates that, after the well-known associations of infant mortality with social factors and latitude are allowed for, water Ca is an important factor in "explaining" the differences between the infant death rates of these towns, but not between their stillbirth-rates. Differences between the towns in the proportions of births to mothers who had already had 3 or more children appear to explain a large part of the modern relationship of social factors with infant mortality, but not the association with water Ca. Anencephaly is also inversely associated with the water minerals in the towns studied; but the correlation is small.—Copyright 1972, Biological Abstracts, Inc.
W73-11144

MERCURY ACCUMULATION BY MYRIOPHYLLUM SPICATUM L., Wisconsin Univ., Madison. Dept. of Soil Science. S. G. Dolan, D. R. Keeney, and G. Chesters. Environmental Letters, Vol 1, No 3, p 191-193, 1971. 3 tab, 5 ref.

Descriptors: "Aquatic plants, "Mercury, "Sediments, "Adsorption, Biology, Plant physiology, Root systems, Organic compounds, Inorganic compounds, Soil contamination, Toxicity, Metabolism, Food chains, Evaluation, Laboratory tests.
Identifiers: Organomercurials.

An investigation of the magnitude and rate of Hg accumulation by a rooted aquatic plant Myriophyllum spicatum L. (watermilfoil)—from solution culture and from Hg-contaminated lake sediments was conducted. As determined by solution culture experiments, Hg accumulation was much greater with inorganic than organic Hg carriers. Mercury accumulation from nutrient solution was rapid and approached maximum values in 2 hours. Organo-Hg compounds were more available than inorganic compounds from lake sediments likely because of precipitation of inorganic Hg as sulfides. Mercury accumulates in rooted aquatic plants by physical adsorption and by metabolic uptake and translocation, the latter occurring mainly with organo-Hg compounds. Rooted aquatic plants might prove to be an important link in the uptake and cycling of Hg derived from contaminated sediments. (Jerome-Vanderbilt)
W73-11168

A CONTINUOUS-FLOW APPARATUS FOR ASSESSING THE TOXICITY OF SUBSTANCES TO MARINE ANIMALS, Ministry of Agriculture, Fisheries and Food, (England). Fisheries Lab. P. M. Connor, and K. W. Wilson. Journal of Experimental Marine Biology and Ecology, Vol 9, No 3, p 209-215, 1972. 3 fig, 12 ref.

Descriptors: "Marine animals, "Toxicity, "Testing procedures, "Instrumentation, "Bioassay, Biochemistry, Aquatic environment, Laboratory tests, Quality control, Water meters, Flow meters, Control systems, Mechanical equipment, Marine biology.

Continuous flow systems for test procedures of acute toxicity on aquatic animals can overcome problems such as waste product accumulation, depletion of dissolved oxygen and changes in the pH and bacterial population which may result from insufficient volumes of water. An efficient continuous flow system is presented. Although the system uses electric pumps, it incorporates a fail-safe system which would maintain the experimental conditions in the event of pump failure. Sea water flows from a constant head tank through flow meters to the 10-liter Perspex treatment tanks. The entering toxin is metered by microperistaltic pumps. Maximum errors of plus or minus 3% were calculated for sea water flows of 10 l/h and plus or minus 2.4% for a toxin flow of 7 ml/h. The apparatus has run for 12 months and has proven reliable, accurate and easy to maintain. (Jerome-Vanderbilt)
W73-11169

OXIDATION OF COPPER (II) SELENIDE BY THIOBACILLUS FERROOXIDANS, Department of Natural Resources, Quebec. Mineral Research Center. A. E. Torma, and F. Habashi. Canadian Journal of Microbiology, Vol 18, No 11, p 1780-1781, 1972. 1 fig, 13 ref.

Descriptors: "Bacteria, "Copper, "Oxidation, "Thiobacillus ferrooxidans, Biochemistry, Metals, Chemical reactions, Metabolism, Toxicity, Catalysts, Digestion, Hydrogen ion concentration. Identifiers: "Selenium, Atomic absorption spectroscopy.

Thiobacillus ferrooxidans is an organism which can tolerate high metal ion concentrations and can oxidize metallic sulfides, low valency inorganic sulfur compounds, ferrous ion and some other compounds. The action of T. ferrooxidans upon copper selenide was investigated. The organism had a catalytic effect on the oxidation process. During leaching for sulfide, acid had to be added to maintain the optimum pH of 2.3. In spite of the high toxicity of selenium, the bacteria grew and multiplied. In this process copper goes into solution and elemental selenium is deposited. (Jerome-Vanderbilt)
W73-11171

ACU-
TRO-
TION
REL-
Acad-
Bene-
D. T.
Jour-
Canad-
ref.

Descri-
"Res-
Phys-
Met-
Test.

Acu-
tribu-
muc-
the g-
either
down
acute
nerit-
tion
hypot-
to b-
death
no lo-
men-
W73

ENV-
TRO-
Flor-
tome-
M. V.
Env-
Ident-
Ecol-
Fiel-

Un-
tor
men-
discu-
mos-
exan-
vect-
ilar-
schiz-
socia-
done-
Afric-
sign-
thes-
popu-
what-
Cop-
W73

ENV-
Col-
R. C.
Min-
Feb

Des-
"Su-
was
Sta-
Ident-
pile-

Poli-
dus-
SO2
exist-
ters
men-
try
app-
with

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

ACUTE ZINC TOXICITY TO RAINBOW TROUT (SALMO GARDNERI): CONFIRMATION OF THE HYPOTHESIS THAT DEATH IS RELATED TO TISSUE HYPOXIA, Academy of Natural Sciences of Philadelphia, Benedict, Md. Benedict Estuarine Lab.
D. T. Burton, A. H. Jones, and J. Cairns, Jr.
Journal of the Fisheries Research Board of Canada, Vol 29, No 10, p 1463-1466, 1972. 2 tab, 12 ref.

Descriptors: *Rainbow trout, *Zinc, *Toxicity, *Respiration, Biochemistry, Fish, Sport fish, Physiology, Cytological studies, Mortality, Metabolism, Oxygen requirements, Inhibitors, Testing.

Acute heavy metal toxicity to fish has been attributed to the coagulation or precipitation of mucus on the gills and/or to cytological damage to the gills. The physiological mechanism of death by either of the above causes is related to a breakdown in gas exchange at the gills. This study of acute zinc toxicity to rainbow trout (*Salmo gairdneri*) supports an earlier hypothesis that modification of the gas exchange process at the gills creates hypoxia at the tissue level. Tissue hypoxia appears to be a major physiological change preceding death once the gas exchange process at the gills is no longer sufficient to supply the oxygen requirements of the fish. (Jerome-Vanderbilt) W73-11180

ENVIRONMENTAL HAZARDS IN THE CONTROL OF DISEASE VECTORS, Florida State Div. of Health, Vero Beach. Entomology Research Center.

M. W. Provost.
Environ Entomol. Vol 1, No 3, p 333-339, 1972.
Identifiers: Africa, Control, *Disease vectors, Ecological studies, *Environmental hazards, Diseases, Malaria, Mosquito, Tsetse.

Unwanted environmental disturbances from vector control practices (pesticides, water management, special tsetse fly control methods, etc.) are discussed. Current control methods for mosquitoes, tsetse flies, black flies and snails are examined because these are vectors of the major vector-borne diseases of the world today: malaria, filariasis, trypanosomiasis, onchocerciasis and schistosomiasis. The assessment is ecological and sociological. Although considerable damage was done, particularly to aquatic environments in Africa, control methods available today pose insignificant hazards to environments. Control of these diseases will continue to increase human populations but the peoples involved must decide what population densities to maintain at what cost to natural environments and quality of living.—Copyright 1973, Biological Abstracts, Inc.
W73-11182

ENVIRONMENT, Colorado School of Mines, Golden. Research Inst. R. C. Merritt.
Mining Engineering, Vol 24, No 2, p 97-101, February 1972. 4 fig.

Descriptors: *Metallurgy, *Metals, *Air pollution, *Sulfur compounds, Copper, Mining, Solid wastes, Waste treatment, Environmental effects, Stabilization, Storage tanks.
Identifiers: Smelting, Nonferrous metals, Tailing piles.

Pollution problems troubling the metallurgical industry are presented. With the introduction of new SO₂ emission standards it became apparent that existing technology available to nonferrous smelters cannot achieve 94% control with the government's estimate of \$108 million. The copper industry alone would achieve only 85% control at a cost approaching \$600 million. It is concluded that without huge capital investments for new production technology, the pollution standards cannot be

met by nonferrous smelters. Although the paper deals primarily with SO₂ emissions several case histories present facts on acid mine drainage water treatment, metal recovery processes, tailings stabilization and metals reclamation from refuse. (Oleszkiewicz - Vanderbilt)
W73-11183

METABOLISM OF TRITIATED WATER IN THE DAIRY COW, California Univ., Livermore. Lawrence Livermore Lab.
For primary bibliographic entry see Field 05B.
W73-11186

PHENYLMERCURIC ACETATE: METABOLIC CONVERSION BY MICROORGANISMS, Wisconsin Univ., Madison. Dept. of Entomology.
For primary bibliographic entry see Field 05B.
W73-11187

ARSENIC IN THE LIPID EXTRACTS OF MARINE INVERTEBRATES, Akademija Nauk SSSR, Vladivostok. Institut Biologii.
V. E. Vaskovsky, O. D. Korotchenko, L. P. Kosheleva, and V. S. Levin.
Comparative Biochemistry and Physiology, Vol 41B, No 4, p 777-784, 1972. 1 fig, 4 tab, 25 ref.

Descriptors: *Marine animals, *Arsenic compounds, *Lipids, *Chromatography, Biochemistry, Invertebrates, Mollusks, Aquatic environment, Distribution, Environmental effects, Data collection, Evaluation, Laboratory tests, Water pollution.
Identifiers: *Arsenic.

The quantitative contents of arsenic in the lipid extracts of twenty-seven species of marine invertebrates, related to various systematic groups, were determined in this study. Arsenic was found in the lipids of the representatives of all phyla. Annelida, Mollusca and Asterioidea had the highest arsenic contents whereas Spongia had the lowest. The lipids of animals of the same species with different habitats were found to have different arsenic contents. Thin-layer chromatography was used to compare arsenic-containing substances obtained from various organisms. Animals from different groups were shown to have different arsenic-containing compounds. The main portions of arsenic-containing substances saponify. (Jerome-Vanderbilt)
W73-11189

TOXIC EFFECTS OF TRACE ELEMENTS ON THE REPRODUCTION OF MICE AND RATS, Dartmouth Coll., Hanover, N.H. Dept. of Physiology.
H. A. Schroeder, and M. Mitchener.
Archives of Environmental Health, Vol 23, No 2, p 102-106, August 1971. 4 tab, 14 ref.

Descriptors: *Trace elements, *Reproduction, *Toxicity, *Rodents, *Potable water, Biochemistry, Bioassay, Metals, Animal pathology, Animal physiology, Growth rates, Metabolism, Lead, Cadmium, Arsenic compounds, Nickel, Titanium, Molybdenum, Analytical techniques, Bioindicators, Testing procedures, Evaluation, Laboratory animals.
Identifiers: Selenium.

Breeding mice and rats were exposed to low levels of six trace elements in drinking water in a controlled environment for three generations. Three elements selenium, lead and cadmium had demonstrated innate toxicities, while three others, arsenic, nickel and molybdenum had no long-term toxicity. A group of mice given only doubly deionized water was used as a control. Selenite (3 ppm) caused excess deaths before weaning, runts,

and failures to breed. Lead (25 ppm) and cadmium (10 ppm) caused loss of the strain within two generations, with many abnormalities. Molybdate (10 ppm) was slightly toxic and arsenic caused only elevated ratios of males to females. In rats, lead was very toxic and titanium and nickel moderately toxic, each causing early deaths and runts. This method provides fairly rapid estimates of innate toxicities of trace elements in doses tolerable for growth and survival. (Jerome - Vanderbilt)
W73-11190

PRAGUE INTERNATIONAL LEAD PANEL: EFFECTS OF ATMOSPHERIC LEAD ON BIOLOGICAL SYSTEMS, Institute of Industrial Hygiene and Occupational Diseases, Prague (Czechoslovakia).

J. Teisinger, C. Kintars, and E. Pfizer.
Science, Vol 179, No 4069, p 197-198, 12 January 1973.

Descriptors: *Lead, *Environmental effects, *Absorption, *Toxicity, Toxins, Public health, Biochemistry, Air pollution, International Commission, Information exchange, Pathology, Human diseases, Animal pathology.
Identifiers: Poisoning, Body burden, Biological effects.

Proceedings of the debate on the effect of atmospheric lead on biological systems of an international panel at the Charles University in Prague, Czechoslovakia, 15 October 1970, are summarized. These discussions highlighted worldwide concern for potential damage to human health from minute concentrations of lead in the atmosphere. The panel presented information on sources of lead, kinetics of lead absorption, distribution and excretion, sensitive biologic measures of the body burden of lead, and biochemical and clinical features of lead poisoning. The discussion centered on air pollution in Japan, the United States and Czechoslovakia, and on health and safety on mine and lead smelters workers in Czechoslovakia, Finland, Germany and Poland. (Oleszkiewicz-Vanderbilt)
W73-11265

METAL TOXICITY TO SEWAGE ORGANISMS, A DISCUSSION, Illinois Univ., Urbana. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W73-11266

ENVIRONMENTAL CONTAMINATION BY LEAD FROM A MINE AND SMELTER, Institute of Occupational and Radiological Health, Belgrade (Yugoslavia).
D. Djuric, Z. Kerin, L. Graovac-Leposavic, L. Novak, and M. Kop.
Archives of Environmental Health, Vol 23, No 4, p 275-277, October 1971. 6 tab, 1 ref. BSS-OH-YUG-1.

Descriptors: *Lead, *Distribution, *Public health, *Mining, Environmental effects, Water pollution, Air pollution, Soil contamination, Absorption, Sampling, Evaluation, Food, Toxicity, Industrial wastes.
Identifiers: *Yugoslavia.

This preliminary report illustrates the contamination of two large areas in Yugoslavia as a result of the operation of lead mines and smelters. A large proportion of the populations in these areas have been continually subjected to atmospheric lead concentrations higher than those of urban areas but lower than those found in the air of lead-using industrial plants. Tables are presented showing: the distribution of particles of lead in the atmosphere; the concentrations of lead found in the water of the Drava and Meza Rivers, the soil of the area, plants and food products; and the concentrations of aminolevulinic acid in the urine of

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

persons in villages within the area of mining and smelting operations as compared to that of persons from uncontaminated areas. Significant levels of lead were present in vegetation from contaminated areas and this showed up in cow's milk which contained more than 1 mg of lead per kilogram. This level could be harmful to infants. Hay contained levels of lead which could be toxic for cattle if used exclusively and continuously. (Jerome-Vanderbilt)
W73-11267

ENVIRONMENTAL IMPACT OF TRACE METALS ON THE NEW LEAD BELT OF S.E. MISSOURI.

Missouri Univ., Rolla. Dept. of Civil Engineering; and Missouri Univ., Rolla. Environmental Health Research Center.

B. G. Wixson, E. Bolter, J. C. Jennett, and K.

Furushohtaman.

Paper presented at American Geophysical Union Fall National Meeting, San Francisco, California. December 6-9, 1971. 13 p, 5 fig, 2 tab, 6 ref, 1 append.

Descriptors: *Industrial wastes, *Heavy metals, *Lead, Water pollution, *Streams, *Missouri, *Eutrophication, Mining, Trace elements, Zinc, Copper, Phosphates, Carbon dioxide, Effluents, Environmental effects, Bacteria, Algae, Evaluation, Sampling, Measurements, Analytical techniques, Air pollution.
Identifiers: *Mixing wastes.

Investigations are underway in the New Lead Belt of Southeastern Missouri, to discover the effects of mining and industrial wastes on a previously unpolluted ecosystem. Sampling of both contaminated and uncontaminated streams in the same area has been possible because of the unusual topography and drainage pattern of this region. Studies of mine effluents entering streams have indicated that mining waste waters contain carbon dioxide and sufficient phosphorus to combine with nitrogen and other trace substances in the streams to cause undesirable benthic growth of bacterial-algal mats. The stresses introduced into the environment by the industry are sulfur dioxide in the tail gases, trace metals in the wind-blown lead concentrate and in the dust coming through the main stacks, and sulfur trioxide-acid mist escaping the acid plant stack. A modeling concept is presently being developed to evaluate the transport of lead and other trace metals in the study area. (Jerome - Vanderbilt)
W73-11271

TRANSFER OF METALLIC MERCURY INTO THE FOETUS,

Rochester Univ. Medical Center, N.Y.

For primary bibliographic entry see Field 05B.

W73-11274

VOLATILIZATION OF MERCURIC CHLORIDE BY MERCURY-RESISTANT PLASMID-BEARING STRAINS OF *ESCHERICHIA COLI*, *STAPHYLOCOCCUS AUREUS*, AND *PSEUDOMONAS AERUGINOSA*,
Washington Univ., St. Louis, Mo.
For primary bibliographic entry see Field 05B.
W73-11286

SEA FISH CONTAMINATION WITH MERCURY (CONTAMINATION DES POISSONS DE MER PAR LE MERCURE),

G. Cumont, G. Viallex, H. Lelievre, and P. Bobenrieth.

Revue Internationale d'Oceanographie Medical, Vol 28, p 95-127, 1972. 15 fig, 10 tab, 6 ref. English summary.

Descriptors: *Mercury, *Marine fish, *Trace elements, Foods, Food chains, Toxins, *Toxicity,

Path of pollutants, Surface waters, Animal pathology, Heavy metals, Water pollution, Standards, Water quality, Analysis, Water pollution effects.

Identifiers: *Fish muscles, *Atomic absorption spectroscopy.

The research and the determination of mercury in the muscle of fish of various species, origin and dimensions show that the concentration of this metal is inferior to norms admitted to-day in most cases. However, the accumulation of mercury is always proportional to the weight of the fish. Consequently, the big individuals at the end of the food chains have concentrations superior to these norms. Fish from some areas show abnormally high rates, which indicate local pollution. (Oleszkiewicz-Vanderbilt)
W73-11289

MERCURY IN THE MARINE ENVIRONMENT: CONCENTRATION IN SEA WATER AND IN A PELAGIC FOOD CHAIN,

Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.

P. M. Williams, and H. V. Weiss.

Journal Fisheries Research Board of Canada, Vol 30, No 2, p 293-295, 1973. 2 tab, 7 ref.

Descriptors: *Mercury, *Sea water, *Food chains, *Marine animals, Marine plants, Sediments, *California, Distribution patterns, Food pyramids, Fish, Plankton, Microorganisms, Trace elements, Water pollution effects, Neutron activation analysis.

Identifiers: *Mercury pollution.

Mercury in seawater, in a pelagic food chain, and in bottom sediment was determined at a single station 430 km southeast of San Diego, California. The concentration of mercury in zooplankton slightly increased with depth of collection. The mercury content in almost all of the higher trophic levels of organisms collected at greater depths was indistinguishable from the concentration of mercury in zooplankton at these depths. Mercury concentration in the seawater column was essentially constant below 100 m and significantly higher at the surface. This vertical profile of mercury content is not ascribable to biological activity. (Oleszkiewicz-Vanderbilt)
W73-11300

THE CASE AGAINST MERCURY,

Robert A. Taft Water Research Center, Cincinnati, Ohio.
R. B. Dean.

Available from the National Technical Information Service as PB-213 692. Paper presented at 71st National Meeting of AIChE, Dallas, Texas, February 20-23, 1972. 11 p, 25 ref.

Descriptors: *Mercury, *Heavy metals, *Toxicity, *Pathology, Analytical techniques, Path of pollutants, Fungicides, Pesticides, Toxins, Animal diseases, Human pathology, Standards, Legislation, Sediments, Sediment-water interfaces, Foods, Food chains, Water pollution, Environmental effects.

Identifiers: *Methylation, Atomic absorption spectroscopy, Organomercurials, Methylmercury.

The toxicity of mercury is increased more than tenfold when it is converted to methylmercury which destroys nerves in the brain and advances senility. Bacteria convert mercury in aquatic sediments into methylmercury which is concentrated by predatory fish. The historical background of mercury pollution is presented, followed by a discussion of the best methods for mercury detection, means by which mercury enters the environment, standards, and Environmental Protection Agency enforcement. (Oleszkiewicz - Vanderbilt)

W73-11303

CERTAIN BIOLOGICAL EFFECTS OF LEAD UPON THE ANIMAL ORGANISM,

Amsterdam Univ., (Netherlands). Coronel Lab. for Occupational Medicine and Environmental Health.

A. de Bruin.

Archives of Environmental Health, Vol 23, No 4, p 249-264, October 1971. 1 fig, 174 ref.

Descriptors: *Lead, *Human pathology, *Toxins, *Metabolism, Biochemistry, Bioassay, Environmental effects, Public health, Analytical techniques, Enzymes, Water pollution, Pollutants, Urine, Metals.
Identifiers: Human blood, Human physiology.

A comprehensive review is presented of the scientific literature relating to the biochemical and physiological results of the absorption of measurable quantities of lead into the bodies of animals and men. The influence of lead on hematopoiesis is discussed in relation to circulating erythrocytes, impairment of hemoglobin production and the stimulation of erythropoiesis in bone marrow. The association of high lead concentrations with anemia resulting from enzyme inhibition, the biochemical and physiological alteration of erythrocytes and the impairment of biosynthesis is considered. Ways in which the detection of biochemical alterations in urine, blood, bone marrow and tissue may be used to avert serious damage from clinical lead poisoning are discussed. A multiplicity of effects induced by sufficient concentrations of lead are demonstrated. (Jerome-Vanderbilt)
W73-11307

BIOCHEMICAL TESTS FOR THE APPRAISAL OF EXPOSURE TO LEAD,

Institute of Occupational and Radiological Health, Belgrade (Yugoslavia).

M. K. Stankovic.

Archives of Environmental Health, Vol 23, No 4, p 265-269, October 1971. 2 tab, 17 ref.

Descriptors: *Lead, Testing, *Urine, Environmental effects, Toxicity, Distribution, Public health, Biochemistry, Sampling, Analysis, Evaluation, Air pollution, Atmosphere, Testing procedures, Bioassay, *Amino acids.
Identifiers: *Yugoslavia, Human physiology.

Absorption of lead in sufficient quantity results in specific chemical responses in the animal metabolism. Recently investigators discovered that amino levulinic acid (ALA) is excreted in the urine of persons suffering from lead intoxication. Thus, its determination has been employed as an early sensitive indicator of excessive absorption of lead. This study presents results and discussion of a systematic observation of working men who had been exposed to lead. Four groups of men totaling 370 persons, selected from environments containing concentrations of lead ranging from no lead to 3.5 mg/cu.m. were tested. Coproporphyrin in urine was analyzed by a quantitative spectrophotometric method. ALA in urine was also measured. The results in mean values are presented in a table which shows the range across the four concentration groups. The occurrence of coproporphyrin in excessive concentrations in urine is not specific evidence of lead absorption, but a good correlation was obvious. It is concluded that the ALA determination of urinary lead is an effective method of determining lead absorption. (Jerome - Vanderbilt)
W73-11309

PHOSPHORUS REMOVAL, A BIBLIOGRAPHY, VOLUME I.

Office of Water Resources Research, Washington, D.C.

For primary bibliographic entry see Field 05D.
W73-11319

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

PHOSPHORUS REMOVAL, A BIBLIOGRAPHY, VOLUME 2.
Office of Water Resources Research, Washington, D.C.
For primary bibliographic entry see Field 05D.
W73-11320

IMPAIRMENT OF THE FLAVOR OF FISH BY WATER POLLUTANTS,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.

D. L. Shumway, and J. R. Palensky.
Copy available from GPO Sup Doc as EP1.23-73-010, \$1.25; microfiche from NTIS as PB-221 480, \$0.95. Environmental Protection Agency, Ecological Research Series Report EPA-R3-73-010, February 1973. 80 p, 9 fig, 12 tab, 15 ref. EPA Project 18050 DDM.

Descriptors: *Fish, *Taste, *Organic compounds, *Pulp wastes, *Sewage effluents, Water pollution, Water quality, *Organoleptic properties, Trout, Bass, Bluegill, Odor.

Identifiers: *Organoleptic evaluation, Laboratory study.

Laboratory studies were conducted with fish to determine an appropriate bio-assay procedure for the examination of the flavor-imparting capacity of wastes and waste components (organic compounds). In addition, the flavor-imparting capacity and estimated threshold concentrations were determined for a number of organic compounds and effluents. Flavor evaluations were obtained through the use of taste panels. Estimated threshold concentrations were determined for twenty two organic compounds. The values ranged from 0.4 ppb (2,4-dichlorophenol) to 95 ppb (formaldehyde). An additional twelve compounds were tested, seven of which were not found to impair flavor at or near lethal levels. Estimated threshold concentrations were determined for effluents from the Corvallis Sewage Treatment Plant, kraft paper mills, and a sulfite-base paper mill. The estimated threshold concentrations for primary, secondary, and secondary chlorinated effluents from the Corvallis plant were determined to be 11-13, 21-23, and 20-26 percent by volume, respectively. The estimated threshold concentrations for the effluents from the kraft and sulfite-base paper mills were about 6 and 36 percent by volume, respectively. (EPA)

W73-11322

ENVIRONMENTAL EFFECTS ON TOXAPHENE TOXICITY TO SELECTED FISHES AND CRUSTACEANS,

Aquatic Sciences, Inc., Boca Raton, Fla.
W. R. Courtney, Jr., and M. H. Roberts, Jr.
Copy available from GPO Sup Doc as EP1.23-73-035, \$1.00; microfiche from NTIS as PB-221 481, \$0.95. Environmental Protection Agency, Ecological Research Series Report EPA-R3-73-035, April 1973. 73 p. EPA Project 18080 DLR, Contract 14-12-532.

Descriptors: *Pesticide toxicity, *Chlorinated hydrocarbons, *Salinity, *Temperature, *Dissolved oxygen, Bass, Mullets, Crabs, Pink shrimp, Path of pollutants, Larvae, Juvenile fish, *Lethal limit, *Crustaceans, Toxicity.

Identifiers: *Toxaphene, salinity, Synergism, *Micropodus salmoides*, *Mugil cephalus*, *Mugil cerema*, *Trachinotus carolinus*, *Callinectes sapidus*, *Panacaea duorarum*, *Sesarma cinereum*, *Rhithropanopeus harrisi*, *Zoëa*, *Megalopa*, *Mysis*, *Protozoa*, Nauplius.

Laboratory studies were conducted to determine lethal limits (96 hr TL50) for Toxaphene, salinity, temperature, and dissolved oxygen and their interaction effects on developmental stages of selected warm-temperate and subtropical fishes and crustaceans. Species tested were *Micropodus salmoides* (Largemouth bass), *Mugil cephalus*

(striped mullet), *Mugil curema* (silver mullet), *Trachinotus carolinus* (pompano), *Callinectes sapidus* (blue crab), *Panacaea duorarum* (pink shrimp), *Sesarma cinereum* (drift line crab), and *Rhithropanopeus harrisi* (mud crab). Histopathological and gross morphological studies were conducted on all early life history stages of the species included. Earliest developmental stages of the fish species treated are more resistant to high levels of salinity, and to low levels of dissolved oxygen, but more sensitive to high temperatures than are later stages. Decapod larvae showed increasing tolerance to Toxaphene with increasing developmental age. Synergistic effects between Toxaphene and the three environmental factors were suggested in the species tested. Some histopathology was noted in fry of bass and mullet, and in larvae of *S. cinereum*, *C. sapidus*, and *R. harrisi*. (EPA)

W73-11323

DEVELOPMENT OF DISSOLVED OXYGEN CRITERIA FOR FRESHWATER FISH,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.

C. E. Warren, P. Doudoroff, and D. L. Shumway.
Copy available from GPO Sup Doc as EP1.23-73-019, \$2.10; microfiche from NTIS as PB-221 513, \$0.95. Environmental Protection Agency, Ecological Research Series Report EPA-R3-73-019, February 1973. 121 p. EPA Project 18050 DJZ.

Descriptors: *Oxygen requirements, *Fish, Fish growth, Fish respiration, Fish reproduction, Salmon, Trout, Bass, Pollution (Water), Aquatic productivity, Water quality, *Dissolved oxygen, Water pollution effects.

Identifiers: *Pacific salmon, *Steelhead trout, *Largemouth bass, Laboratory studies.

Research has involved laboratory studies on the survival, development, bioenergetic and growth, swimming performance, and avoidance behavior of chinook and coho salmon, steelhead trout, and largemouth bass. Some studies have been conducted under very simple laboratory conditions, as in aquaria or other apparatus, but some studies on bioenergetics and growth have also been conducted under rather natural conditions in laboratory streams and ponds. In some important cases, close correspondence was found between the effects of reduced oxygen concentration in aquarium studies of growth at maximum rations and its effects under more natural conditions in laboratory streams and ponds. Some of the biological responses of the fish studies were affected by any appreciable reduction in dissolved oxygen below the air saturation levels, whereas others were affected only at levels below about 50 percent of the air saturation levels. (EPA)

W73-11327

LIMNOLOGY OF YELLOWTAIL RESERVOIR AND THE BIG HORN RIVER,
Montana State Univ., Bozeman.

J. C. Wright, and R. A. Soltero.
Copy available from GPO Sup Doc as EP1.23-75-002, \$1.25; microfiche from NTIS as PB-221 487, \$0.95. Environmental Protection Agency, Ecological Research Series Report EPA-R3-73-002, February 1973. 105 p, 32 fig, 19 tab, 83 ref. EPA Project 18050 DBW.

Descriptors: Water chemistry, *Impounded waters, *Light penetration, *Primary production, *Phytoplankton, *Withdrawal, Density stratification, Thermal stratification, Turbidity currents, Ammonia, Nitrates, Nitrites, Phosphates, Trace elements, Turbidity, *Montana, *Wyoming, Reservoir releases.

Identifiers: *Bighorn Lake.

Impoundment and deep water withdrawal displaced the maximum and minimum temperatures and conductivities of the effluent two to four

months behind the influent occurrence and greatly reduced the amplitude of seasonal change. Of the influent total carbon, nitrogen and phosphate, 24%, 25% and 86% respectively were retained in the reservoir. The major fraction retained was the particulate portion. A significant correlation was found between total phosphate, orthophosphate and turbidity. Nitrate, ortho-phosphate and trace metals were in higher concentration in the upper end of the reservoir associated with turbid water. A withdrawal caused density current was evident which altered the vertical and longitudinal distribution of physical and chemical parameters. Volume based phytoplankton density and chlorophyll concentration decreased down-reservoir. However, the depth of the euphotic zone increased down-reservoir as silt settled out. Consequently the euphotic zone standing crops were greatest in the mid-section of the reservoir. Insufficient light penetration was the principal limiting factor to primary production in the upper end of the reservoir. Decreased primary productivity in the lower end of the reservoir did not appear to be due to nutrient limitation. (EPA)

W73-11331

FISH AND FOOD ORGANISMS IN ACID MINE WATERS OF PENNSYLVANIA,
Pennsylvania State Univ., University Park. Dept. of Biology.

R. L. Butler, E. L. Cooper, D. C. Hales, C. C. Wagner, and W. G. Kimmel.

Copy available from GPO Sup Doc as EP1.23-73-032, \$2.10; microfiche from NTIS as PB-221 515, \$0.95. NTIS PC54-60. Environmental Protection Agency report number, EPA-R3-73-032, February 1973. 158 p, 41 fig, 28 tab, 76 ref. EPA Project 18050 DOG.

Descriptors: *Water pollution effects, *Acid mine water, *Bioassay, Water quality, *Fish behavior, Distribution patterns, Acidity, Invertebrates, *Pennsylvania, Mine drainage, *Aquatic insects, Lethal limit, Toxicity.

Objectives were: (1) develop a rapid and non-lethal bioassay for acid water using changes in utilization of cover and activity of fish, (2) determine the effect of different levels of acid mine drainage on the presence of absence or fish populations in the watersheds of Pennsylvania, (3) determine the median tolerance limits to low levels of pH of five aquatic insects chosen on the basis of their wide occurrence and common association in soft-water streams. Analysis of variance revealed there was no relationship between cover utilization and pH levels or between activity and pH levels for four species of fish (smallmouth bass, longnose dace, rock bass and brook trout). In part II of the project it was found that common fish species normally distributed over several watersheds were absent where there was severe acid mine drainage. Of the 116 species of fishes found 10 species exhibited some tolerance to acid mine drainage (values of pH 5.5 or less). In part III all aquatic species survived exposure for four days to pH levels from 6.5 to 4.0. The 96-hour TL50 values ranged from 3.31 for the most sensitive animal, *Stenonema sp.*, to 1.72 for the most tolerant insect, *Nigronia fasciata*. (EPA)

W73-11332

RESEARCH AND THE PROBLEMS OF TWO SEAS,
For primary bibliographic entry see Field 02L.

W73-11350

SOME THERMAL CONSEQUENCES OF ENVIRONMENTAL MANIPULATIONS OF WATER,
Texas Univ., Austin. Dept. of Zoology.

C. Hubbs.
Biol Conserv. Vol 4, No 3, p 185-188. 1972.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

Identifiers: Biota, *Environmental effects, Manipulations, *Thermal pollution, Water pollution effects.

Environmental manipulations can alter thermal regimes, upset the delicate adaptations of natural populations, and have adverse effects on the native biota. The resulting problems can be exacerbated by reducing 24-hourly oscillations, increasing potentiality for thermal shock, and causing reproduction to occur at adverse temperatures.—Copyright 1972, Biological Abstracts, Inc.
W73-11355

MERCURY—A CASE STUDY OF MARINE POLLUTION,
World Health Organization, Copenhagen (Denmark). Regional Office for Europe.
For primary bibliographic entry see Field 05B.
W73-11375

A FEW COASTAL POLLUTION PROBLEMS IN JAPAN,
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.

J. U.I.
In: The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 171-176, 1972. 1 fig, 1 tab, 7 ref.

Descriptors: *Coasts, Water pollution effects, Pollutants, *Mercury, *Cadmium, *Polychlorinated biphenyls, Diseases, Fish, Food chains, *Human diseases, Toxicity.

Identifiers: Japan, *Minamata disease, *Itai-itai disease.

Mercury (Hg) compounds have been widely used in various fields of industry, as well as a fungicide in rice fields and have produced the first case of actual danger to human health from industrial activities. The disease, produced by ingestion of contaminated fish, has been called Minamata Disease and is associated with methyl-Hg. The magnitude of accumulation of Hg in fish and other biomass could be influenced by the ratio of Hg input and the quantity of existing organic material or the rate of primary production that region. Cadmium has been found to produce another strange disease called 'Itai-itai,' with pain and fracture in bones, but in this case there is no evidence of the formation of an organo-metallic compound of Cd, such as the one for Hg. PCB is another compound with a strong persistence and a strong accumulation tendency that is considered a potential health hazard. (See also W73-11367) (Ensign-PAI)
W73-11376

FACTORS CONTROLLING MARINE ECOSYSTEMS,
Marine Lab., Aberdeen (Scotland).

J. H. Steele.
In: The Changing Chemistry of the Oceans; Proceedings of the 20th Nobel Symposium, August 16-20, 1971, Goteborg, Sweden: Wiley Interscience Division of John Wiley and Sons, Inc., p 209-221, 1972. 5 fig, 20 ref, append.

Descriptors: *Marine biology, *Ecosystems, *Food chains, Primary productivity, Productivity, Fish, Path of pollutants, Comparative productivity, Food pyramids, Trophic level, Carnivores, Herbivores.
Identifiers: *Marine ecosystems.

In the sea probably 90% or more of the plant production is eaten by herbivorous zooplankton and the fallout of organic matter to the sea below the euphotic zone is largely faecal material. In consequence the phytoplankton biomass is of the same order of magnitude as the herbivores. Less than 10% of plant material on land is eaten while

living, and nearly all enters the decomposer cycle. For this reason vegetation normally dominates the biomass. These very different patterns of energy flow have obvious consequence for the passage of pollutants through the food chains, particularly the accumulation of persistent toxins at higher trophic levels in the marine system. Significant changes are most likely to arise when the organisms affected have a major role in controlling other groups or trophic levels. Theories of control of terrestrial ecosystems do not appear adequate as a basis for considering effects on marine systems. Under normal conditions in the sea nearly all the energy produced by phytoplankton passes through the zooplankton before it enters higher trophic levels. The feeding patterns of copepods are probably a critical factor in maintaining this close control. The rate of predation by carnivores may be determined more by efficiency of energy conversion than as a general controlling factor and so, although large changes would obviously alter the system, smaller disturbances are more likely to affect us through our commercial harvest of predators. (See also W73-11367) (Knapp-USGS)
W73-11380

THE ACCELERATION OF THE HYDROGEOCHEMICAL CYCLING OF PHOSPHORUS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).

For primary bibliographic entry see Field 05B.
W73-11385

PRESERVATION OF LAKE BAYKAL (OB OKHRANE OZERA BAYKAL),
Hydrometeorological Service of the USSR, Moscow.

Yu. A. Izrael', and A. A. Zenin.
Meteorologiya i Gidrologiya, No 1, p 15-19, January 1973.

Descriptors: *Lakes, *Water conservation, Waste water treatment, Waste water disposal, Waste water (Pollution), Environmental sanitation, Water purification, Water quality control, Industrial wastes, Effluents, On-site investigations, *Water quality standards.

Identifiers: *USSR, *Lake Baykal.

The present state of Lake Baykal and measures to protect it during intense economic development in the lake basin are described. Data are presented on the effects of treated waste water from the Baykal'sk cellulose plant on the water quality and life cycle of the lake. Studies are currently underway at scientific institutions to determine the effect of human activity on chemical, hydrologic, and hydrobiologic regimes of the lake and to establish discharge-waiver standards for dumping pollutants into bodies of water. (Josefson-USGS)
W73-11407

COMBINED EFFECT OF THERMAL AND ORGANIC POLLUTION ON OXYGEN SAG CURVE,
Worcester Polytechnic Inst., Mass.

K. Keshavan, and G. C. Sornberger.
Available from the National Technical Information Service as PB-221 533, \$3.00 in paper copy, \$0.95 in microfiche. Massachusetts Water Resources Research Center, Amherst, Final Technical Report, 1973, 35 p. OWRR C-3027 (3674).

Descriptors: *Dissolved oxygen, *Model studies, Oxygen sag, *Thermal pollution, Respiration, Temperature gradient, Dispersion, Temperature. Identifiers: *Oxygen Sag Curve, *Organic pollution.

A deterministic model is developed for the oxygen sag curve for a variable temperature condition

under thermal overload. With the help of the above model, optimal locations of thermal and organic outlets with respect to each other can be determined for a predetermined minimum dissolved oxygen concentration in the river.
W73-11423

THE RELATIONSHIP OF ENZYME KINETIC HETEROPTROPHY ANALYSIS TO OTHER EUTROPHICATION INDICES,
Utah State Univ., Logan. Dept. of Wildlife Science.

D. D. Koob.

Available from the National Technical Information Service as PB-221 540, \$3.00 in paper copy, \$0.95 in microfiche. Research Report 11, June 1973. Utah Agricultural Experiment Station, Utah State University. 14 p, 8 fig, 32 ref. OWRR A-013 UTAH (1).

Descriptors: *Primary productivity, Oligotrophy, *Eutrophication, Coliforms, *Utah, Kinetics.

Identifiers: Dark uptake, Inorganic carbon, Bear Lake (Utah), *Enzyme kinetics, *Heterotrophy analysis.

Three locations in Bear Lake, an ultraoligotrophic lake on the Utah-Idaho border, were sampled for five eutrophication indicators - primary productivity, total bacterial concentrations, coliform concentrations, Vt values, and dark uptake rates for inorganic carbon. In general, samples from the northern and central water gyres of the lake were similar, but different from samples from the southern gyre. No numerically significant correlations were found between any two of the parameters tested, although similar weekly patterns of change were noted for dark uptake of inorganic carbon and Vt values at two of the locations. Highest rates of carbon fixation (both photosynthetic and nonphotosynthetic) and of organic carbon uptake occurred at the location nearest concentrated human occupation. High values for coliform counts, Vt values, and primary productivity occurred during periods of high tourist activity. A stimulatory influence of Swan Creek inflow on primary productivity was indicated.
W73-11432

EFFECTS OF LOGGING ON GROWTH OF JUVENILE COHO SALMON,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.

F. M. Iwanago, and J. D. Hall.

Copy available from GPO Sup Doc as EP1.23:73-006, \$0.75; microfiche from NTIS as PB-221 541, \$0.95. Environmental Protection Agency, Ecological Research Series Report EPA-R3-73-006, April 1973. 35 p. EPA Project 18050 FKT.

Descriptors: *Salmon, *Growth rates, *Thermal stress, *Lumbering, Clear-cutting, Fish, Fish parasites, *Oregon, Water temperature, Pacific Northwest U. S., Juvenile fish.
Identifiers: *Coho salmon (Juvenile).

The objective was to study the effects of increased water temperature characteristic of clearcut watersheds of Pacific coastal streams upon the growth rate of juvenile coho salmon. The natural temperature fluctuations of the stream were used in the study of growth of underyearling fish held in aquaria and fed at various consumption levels. Juvenile coho fed in the control stream grew somewhat faster than did those that experienced the warmer temperatures of the clearcut stream. This was particularly true at low levels of consumption. Growth rates of juvenile coho salmon in the wild state were found to be slightly higher in the clearcut stream as compared to the unlogged stream. This difference from the experimental results may have been due to a change in availability and abundance of food. There was a marked decrease in the cutthroat trout population in the

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

clearcut stream, which may have reduced competition for food. There was no apparent influence of infestation by salmon poisoning fluke on the condition of the juvenile coho in the clearcut stream. (EPA)
W73-11433

STANDARD DISPERSANT EFFECTIVENESS AND TOXICITY TESTS,
Edison Water Quality Research Lab., N.J.
For primary bibliographic entry see Field 05A.
W73-11442

THE EFFECTS OF TEMPERATURE ON GROWTH AND REPRODUCTION OF AQUATIC SNAILS,
Michigan Univ., Ann Arbor. Museum of Zoology.
H. van der Schalie, and E. G. Berry.
Copy available from GPO Sup Doc as EPI.23-73-021, \$2.35; microfiche from NTIS as PB-221 549, \$0.95. Environmental Protection Agency, Ecological Research Series Report EPA-R3-73-021, February 1973. 164 p, 58 fig, 20 tab, 99 ref. EPA Project 18050 FOG.

Descriptors: Aquatic animals, *Snails, *Thermal pollution, *Growth, *Reproduction, Water pollution effects, Temperature.
Identifiers: *Operculate snails, *Pulmonate snails.

The effects of temperature on the following freshwater snails were studied: *Lymnaea stagnalis*, *L. marginata*, *Helisoma trivolvis*, *H. anceps*, *H. campanulatum* and *Physa gyrina* - all pulmonate 'pond' snails; one gill-breathing operculate (*Amplicola limosa*) was also tested. Both growth and egg-laying were measured in temperatures ranging from 6 to 36°C. Gonad development was determined through serial paraffin sections; reproduction was measured in terms of egg-laying. The lymnaeids grow best at 18°C; egg production is better at 22°C. In contrast, the planorbids grow better under warmer conditions (about 25°C); however, when 30°C is reached growth may appear better but reproduction is inhibited. The physids tolerate the widest range, sometimes conditions warmer than 30°C, although at this temperature reproduction is also inhibited. The one operculate, *Amplicola limosa*, studied had a preference for cool conditions; i.e., it was like the lymnaeids in temperature responses. The groups varied in response to temperature as indicated, but none could be cultured much below 12°C and none would reproduce at temperatures above 30°C. Mollusks are very sensitive to ambient temperatures; even small changes are important in their influence on the environmental area affected. Studies are encouraged to determine the effects of temperature changes well in advance of projected developments. (EPA)
W73-11444

ORGANIC LOADING OF PETENWELL RESERVOIR, WISCONSIN,
Wisconsin Univ., Madison.
J. W. Kluesener, and G. F. Lee.
Journal of Water Pollution Control Federation, Vol 45, No 2, p 269-282, February 1973. 8 fig, 4 tab, 18 ref.

Descriptors: *Dissolved oxygen, *Organic loading, *Pulp wastes, *Ice cover, Biochemical oxygen demand, Water pollution, Pulp and paper industry, Chemical analysis, Water analysis, Organic wastes, Water pollution effects, Water pollution sources, Reaeration, Wisconsin, Flow, Photosynthesis, Water sampling, River flow, Rivers, Absorption, Sediments, Nutrients, Air-water interfaces, Organic matter.
Identifiers: *Petenwell Reservoir, Wisconsin River, Reaeration coefficients, Nekoosa Dam.

Studies were conducted on the Wisconsin River from Nekoosa, Wisconsin, to the Petenwell Reservoir to determine organic loading to and conditions

in the Petenwell Reservoir specifically during the winter period of ice cover. Determinations made using 20 sampling sites include: flow, DO, BOD, nitrogen, phosphorus, photosynthesis, and sedimentary oxygen uptake. Stream profile studies were conducted at 3 sites. The river in this area had large excesses of biodegradable materials, chiefly from pulp and paper mills, compared to the oxygen available during the periods of late summer and winter ice cover. Reaeration and photosynthesis were not sufficient to overcome the oxygen deficit. Frequently, dissolved oxygen concentrations near zero were obtained in the Wisconsin River between Nekoosa and the Petenwell flowage. In the winter under ice cover, approximately 360,000 lb (163,000 kg) of BOD entered Petenwell flowage in excess of available oxygen. This resulted in large parts of the flowage having essentially zero dissolved oxygen. The primary source of oxygen-demanding materials was the organic matter dissolved and suspended in the water. The sludge deposits and natural lake sediments were estimated to have a minor effect on the oxygen concentrations in the water. (Holoman-Battelle)
W73-11486

REPORT ON EVALUATIONS OF WASTE SOURCES IN THE CALCASIEU RIVER BASIN, LOUISIANA.
National Field Investigations Center-Denver, Colo.
For primary bibliographic entry see Field 05B.
W73-11529

HANDBOOK OF TOXIC CHEMICALS (SECOND EDITION, REVISED AND SUPPLEMENTED),
O. N. Prokof'yev.

Available from NTIS, Springfield, Va., 22151 as AD-746 649, Price \$8.50 printed copy; \$0.95 microfiche. Army Materiel Command Foreign Science and Technology Center Technical Translation Report FSTC-HT-23-1065-72, 1972. 125 p, 21 ref, append. (Translation of Spravochnik po yadokhimikatam izdaniye vtoroye, ispravlennoye i dopolnennoye; 'Kaynar' Press, Alma-Ata, 1968.)

Descriptors: *Toxins, *Chemicals, *Pesticides, *Herbicides, Environmental effects, Chemical properties, Water pollution sources, Reviews, Evaluation, Toxicity, Agricultural chemicals, Plant growth regulators, Soil contamination effects.
Identifiers: *Toxic chemicals handbook.

This handbook gives agricultural specialists necessary information on various toxic chemicals and methods for their use. Toxic chemicals and herbicides are described in alphabetical order according to groups of preparations. In employing resources for plant protection, it is important to select that preparation which will insure the greatest effect for the least expense in labor and resources. It is necessary to know the physicochemical and toxicological properties of toxic chemicals and herbicides, as well as the biological characteristics of treated crops, pests, diseases, and weeds. (Woodard-USGS)
W73-11554

MERCENARIA MERCENARIA (NORTHERN QUAHOG (HARD-SHELL CLAM)) FROM THE BAY OF FUNDY AND GULF OF MAINE,
Guelph Univ. (Ontario). Dept. of Zoology.
D. E. Gaskin, R. Frank, M. Holdren, K. Ishida, and C. J. Walton.
Journal of the Fisheries Research Board of Canada, Vol 30, No 3, p 471-475, March 1973. 2 tab, 7 ref.

Descriptors: *Mercury, *DDT, *Polychlorinated biphenyls, *Dieldrin, *Pollutant identification, Marine animals, Mammals, Maine, Canada, Gas

chromatography, Sea water, Chlorinated hydrocarbon pesticides, Heavy metals, Solvent extractions, Insecticides, Separation techniques. Identifiers: **Phoca vitulina*, Gulf of Maine, Bay of Fundy, Harbor seals, Sample preparation, Animal tissues, Atomic absorption, Seals (Animals), Liver, *Phocoena phocoena*, Muscle, Blubber, Adipose tissue, Cerebrum, Brain, Spectrophotometry, Harbor porpoises, Porpoises, Fat tissue.

Samples of blubber, longissimus muscle, liver and cerebrum from 12 harbour seals (*Phoca vitulina*) were analyzed for DDT, dieldrin, PCBs, and total mercury content. Analysis for total mercury was as previously described by Gaskin et al. (1972), whereby elemental Hg was released and read as a cold vapor at 253.7 nm with an AA-5 Techtron atomic absorption spectrophotometer. For organochlorine compound estimation macerated samples were subjected to exhaustive soxhlet fat extraction with hexane, cleaned on a florisil column and eluted with 20 percent dichloromethane in hexane. An aliquot was dissolved in hexane after preliminary GC analysis and introduced to an activated coconut charcoal column to separate the DDT group from PCBs. The DDT group was eluted with 25 percent acetone in ether, the PCBs with benzene, and both fractions passed through a mixed phase column for residue qualification and quantitation by GC. The results were compared with those obtained previously for harbour porpoises (*Phocoena phocoena*). DDT and PCB levels appear to be of the same magnitude in the fat of seals from both southern New Brunswick and southern Maine, being lowest in a lactating female. Virtually no o, p'-DDT and relatively little dieldrin were found in seal fat, in contrast to porpoises, which contained significant amounts of both in the depot fat. Mercury levels were generally similar to those found for porpoises, but total liver Hg was considerably greater in adults from the New Brunswick islands than in those from the southern Maine ledges. (Holoman-Battelle)
W73-11577

RESIDUES OF CHLORINATED HYDROCARBON PESTICIDES IN THE NORTHERN QUAHOG (HARD-SHELL CLAM), MERCENARIA MERCENARIA-1968 AND 1969,
Rhode Island Dept. of Health, Providence. Div. of Labs.
R. M. Check, and M. T. Canario, Jr.

Pesticides Monitoring Journal, Vol 6, No 3, p 229-230, December 1972. 1 fig, 1 tab, 3 ref.

Descriptors: *Pesticide residues, *Chlorinated hydrocarbon pesticides, *Pollutant identification, Clams, Chemical analysis, Sampling, Rhode Island, DDT, DDD, DDE, Dieldrin, Solvent extractions, Shellfish, Marine animals, Mollusks, Invertebrates. Identifiers: **Mercenaria mercenaria*, Northern quahog, Macroinvertebrates, Animal tissues, Thin layer chromatography, Electron capture gas chromatography, Sample preparation, Mount Hope Bay, Narragansett Bay, p,p'DDD, Isomers, p,p'DDE, p,p'DDT, o,p'DDE, Detection limits.

Samples of the northern quahog (Hard-shell clam), *Mercenaria mercenaria*, were collected monthly, when possible, from September 1968 to September 1969 at five locations in Narragansett Bay, Rhode Island, and one location in nearby Mount Hope Bay. The clams were shucked and drained; a 300-g composite sample of meat (14-18 clams from each location) was blended until homogenized, and frozen until analysis by electron capture gas chromatography. All pesticides residues found were confirmed by thin layer chromatography using precoated aluminum oxide G plates. All 56 composite samples contained dieldrin at an average level of 0.040 ppm; p,p'DDD was present in three samples at an average level of 0.026 ppm. Quahogs from upper reaches of Narragansett Bay contained

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

higher levels of residues than samples from lower Bay areas. (Holoman-Battelle)
W73-11579

DDT, DDE, AND POLYCHLORINATED BIPHENYLS IN BIOTA FROM THE GULF OF MEXICO AND CARIBBEAN SEA—1971,
Texas A and M Univ., College Station, Dept. of Chemistry.
For primary bibliographic entry see Field 05B.
W73-11580

PROGRESS REPORT ON WATER QUALITY OF LAKE MICHIGAN NEAR CHICAGO,
Chicago Dept. of Water and Sewers, Ill.
For primary bibliographic entry see Field 05B.
W73-11581

EFFECTS OF LOGGING ON PERiphyton IN COASTAL STREAMS OF OREGON,
New Mexico Univ., Albuquerque. Dept. of Biology.
E. W. Hansmann, and H. K. Phinney.
Ecology, Vol 54, No 1, p 194-199, Winter 1973. 3 fig, 1 tab, 9 ref.

Descriptors: *Water pollution effects, *Logging, *Oregon, *Streams, *Chlorophyta, *Cyanophyta, *Dissolved oxygen, *Water temperature, *Sediment load, *Chrysophyta, Dominant organisms, Periphyton, Diatoms, Sediments, Samping, Chlamydomonas, Phytoplankton, Anabaena, Biological communities, Artificial substrates.
Identifiers: Deer Creek (Oregon), Flynn Creek (Oregon), Needle Branch (Oregon), Sphaerotilus natans, Draparnaldia glomerata, Spirogyra gracilis, Tetraspora, Anabaena affinis, Oscillatoria amphibia, Diatoms, hiemate, Synechococcus rumpens, Acanthantes minutissima, Nitzschia palea, Eu-nostia arcus, Cocconeis placentula, Achnanthes lanceolata.

Changes in the stream algal flora were observed during a multi-disciplinary logging study of small watersheds in Oregon. Clearcut logging was applied to one watershed of 71 hectares, while a second watershed of 304 ha was patch-cut leaving a buffer-strip of vegetation along the stream channel. A third watershed of 203 ha was not logged but remained as a control. Pre-logging and post-logging oxygen levels, temperature, and sedimentation loads were analyzed. Access roads were built in 1963, and logging completed in 1966. Analysis of the algal communities of the three watershed streams prior to the logging operation of 1966 indicated that the communities were predominantly a periphyton type composed mainly of diatoms. Immediately following the yarding operation of the clearcut watershed, large quantities of Sphaerotilus natans colonized all debris and mud in the stream, and a change in the algal flora appeared to take place. Large mats of green algae were observed colonizing all mud and slush. Results from glass substrates indicate that some changes may have taken place in the diatom community. (Little-Battelle)
W73-11582

MERCURY IN HARBOUR PORPOISES (PHOCOENA PHOCOENA) FROM THE BAY OF FUNDY REGION,
Guelph Univ. (Ontario). Dept. of Zoology.
D. E. Gaskin, K. Ishida, and R. Frank.
Journal of the Fisheries Research Board of Canada, Vol 29, No 11, p 1644-1646, November 1972. 2 fig, 10 ref.

Descriptors: *Mercury, *Chemical analysis, *Pollutant identification, Heavy metals, Mammals, Marine animals, Methodology.
Identifiers: *Harbor porpoises, *Phocoena phocoena, *Animal tissues, *Cold vapor atomic

absorption spectrophotometry, Bay of Fundy, Liver, Muscle, Sample preparation.

During 1969-1971, 41 muscle and 20 liver samples were collected from harbour porpoises (*Phocoena phocoena*) in the Bay of Fundy region. These tissues were analyzed for total mercury content by cold vapor AAS. Total Hg levels ranged from 0.21 to 1.92 ppm (average 0.75) in muscle tissue of males and from 0.26 to 2.58 ppm (average 1.02) in muscle tissue of females; from 0.89 to 18.30 ppm in liver tissue of males and from 0.55 to 91.30 ppm in liver tissue of females. Averages for the two latter series would be meaningless. A limited number (four muscle and six liver samples) of determinations of the methylated fraction were also made. In the muscle, Hg was virtually 100 percent methylated; in the liver the methylated fraction varied from 7.4 to 41 percent, being lowest in livers with highest total Hg. (Holoman-Battelle)
W73-11588

ACUTE AND LONG-TERM ACCUMULATION OF COPPER BY THE BROWN BULLHEAD, Ictalurus nebulosus,
National Water Quality Lab., Duluth, Minn.
W. A. Brungs, E. N. Leonard, and J. M. McKim.
Journal of the Fisheries Research Board of Canada, Vol 30, No 4, p 583-586, April 1973. 4 tab, 11 ref.

Descriptors: *Bioassay, *Copper, Heavy metals, Toxicity, Water pollution effects.
Identifiers: *Brown bullhead, *Ictalurus nebulosus, Biological samples, Gills, Opercle, Liver, Kidney, Blood, Bioaccumulation.

A study was conducted to determine the acute and long-term toxicity and accumulation of copper by the brown bullhead (*Ictalurus nebulosus*) and to investigate the use of copper residues as a possible autopsy procedure. In addition, an attempt was made to collect some initial information on the transport, distribution, and accumulation rate of copper in fish. The fish were exposed to constant concentrations of copper ranging from 6.5 to 422 micrograms/liter. Copper concentrations in gill, opercle, liver, and kidney tissues of live fish did not differ from those that died during the acute exposure. Exposure of fish to sublethal concentrations for 20 days before exposure to lethal concentrations resulted in higher tissue levels in the dead fish than in fish not previously exposed. A distinct increase in liver and gill tissue copper concentrations occurred at exposure levels of 27 micrograms/liter and above. Equilibrium tissue levels of copper in the liver and gill were reached within 30 days. Copper levels in red blood cells and plasma after 20-months exposure did not differ from the controls. Red blood cells analyzed after 6-days and 30-days exposure to copper also showed increased copper residues. (Little-Battelle)
W73-11593

EFFECT OF CHLORINE ON FLUORESCENT DYES,
California State Dept. of Public Health, Berkeley. Bureau of Sanitary Engineering.
D. G. Deane.
Journal Water Pollution Control Federation, Vol 45, No 3, p 507-514, March 1973. 9 fig, 2 tab, 3 ref.

Descriptors: *Fluorescent dye, *Chlorine, *Water pollution effects, *Laboratory tests, *Fluorometry, Dye concentrations, Halogens, Fluorescence, Gases, Tracers.
Identifiers: Dissipation rates, Rhodamine WT, Organic dyes, Rhodamine B, Fluorescein, Pontacyl pink B, Chlorine residual.

A study was conducted to determine the effect of chlorine on four widely used fluorescent dyes: fluorescein, rhodamine B, rhodamine WT, and pontacyl pink B. All tests were performed in the laboratory using batch samples contained in 1-l

glass bottles. Different dye concentrations were subjected to various chlorine residuals and fluorescence intensities were measured at selected time intervals. Analysis of the results provided the following conclusions: (1) Chlorine has little effect on the fluorescence of the dyes rhodamine B and rhodamine WT at chlorine residuals normally found (2 to 9 mg/l). This conclusion reflects the long-term, steady-state condition when dye and chlorine are mixed instantaneously. In cases where the dye and chlorine are added in close proximity to each other, the loss of dye may vary from that predicted from data obtained in these experiments. (2) At high chlorine residuals, quenching of fluorescence was a result of the effects of chlorine as opposed to the effects of pH change. (3) Dissipation of chlorine residuals followed the equation C equals C sub 0 minus k_t, with k_t varying between 0.001/min and 0.006/min. (Holoman-Battelle)
W73-11597

A CYPRINODONTID FISH, JORDANELLA FLORIDA, AS A LABORATORY ANIMAL FOR RAPID CHRONIC BIOASSAYS,
National Water Quality Lab., Duluth, Minn.
W. E. Smith.

Journal of the Fisheries Research Board of Canada, Vol 30, No 2, p 329-330, February 1973. 4 ref.

Descriptors: *Toxicity, *Bioassay, *Laboratory animals, *Laboratory tests, *Water pollution effects, Freshwater fish, Fish reproduction, Killifishes.
Identifiers: *Jordanella floridae, *Flagfish.

The flagfish (*Jordanella floridae*) is proposed as a useful laboratory fish for chronic toxicity studies. It matures rapidly, reaching breeding age in 6 to 8 weeks under optimum conditions, and the fish will spawn at any time of the year. The adults are sexually dichromatic. A complete chronic test may be conducted with this species in as little as 3 to 4 months. (Holoman-Battelle)
W73-11598

MACROBENTHIC ECOLOGY OF A SAWDUST-BEARING SUBSTRATE IN THE PENOBSCOT RIVER ESTUARY (MAINE),
Maine Univ., Orono. Dept. of Zoology.
W. K. Shorey.

Journal of the Fisheries Research Board of Canada, Vol 30, No 4, p 493-497, April 1973. 3 fig, 2 tab, 9 ref.

Descriptors: *Benthic fauna, *Ecology, *Estuarine environment, Annelids, Mollusks, Crustaceans, Nematodes, Systematics, Benthos, Maine, Estuaries, Invertebrates, Clams, Marine animals, Bottom sampling, Hydrography, Dissolved oxygen, Water temperature, Salinity, Classification, Copepods, Oligochaetes, Amphipoda.
Identifiers: *Penobscot River, *Macroinvertebrates, *Sawdust, Substrates, Echinoderms, Nemerteans, Species abundance, Polychaetes, Macoma balthica, Mya arenaria, Prionospio malmgreni, Corophium volutator, Sample preservation, Pycnogonids, Scolecolepides viridis, Polydora, Mytilus edulis, Heteromastus filiformis, Pygospio elegans, Balanus balanoides, Aglaophamus, Nephtys incisa, Polydora, Gammarus lawrencianus, Phoxocephalus holboelli, Aricidea jeffreysii.

The macrobenthos of sawdust-bearing substrates in the Penobscot River estuary (Maine) were sampled bimonthly from January through November 1968. The polychaete *Scolecolepides viridis* and the bivalves *Macoma balthica* and *Mya arenaria* dominated the sandy sediments of the shallow station. *Prionospio malmgreni* and *Corophium volutator* were dominant in the granular substrate of the deeper station. The population of the shallow station (1-m depth, mean low water) was seasonally

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

more stable and had a higher mean monthly bio-index (number of individuals/number of species) than that of the deeper station (6-m depth, mean low water). (Holoman-Battelle)
W73-11602

THE INFLUENCE OF SIMAZINE ON THE PHOTOSYNTHETIC PIGMENTS OF GREEN ALGAE,

L. N. Paramonovskaya, and G. N. Lyalin.

Available from the National Technical Information Service as AD-754 220. Defence Research Information Centre, Orpington, England, Translation No. 2992, DRIC-BR-30358, November 1972. 10 p., 3 fig., 2 tab., 17 ref. Translated from *Fiziologiya Rasteniy*, Vol 15, No 6, p 1002-1007, 1968.

Descriptors: *Herbicides, *Triazine pesticides, *Water pollution effects, *Plant pigments, Pesticide toxicity, Chlorophyll, Aquatic algae, Chlorinated hydrocarbon pesticides.

Identifiers: *Simazine, *Chlorella vulgaris, *Ankistrodesmus braunii, *Chlorosarcina, Photosynthetic pigments, Luminescence spectra, Lutein, Carotin, Chlorophyll a, Culture media.

The amount of chlorophyll a and b, carotin, lutein and violaxanthin and the chlorophyll luminescence spectra were determined after the incubation for 2, 7 and 17 days of three species of green algae in a medium which either contained or did not contain simazine. The pigment content, and particularly that of lutein, carotin and chlorophyll a, decreased in the cells of the herbicide sensitive species Chlorella vulgaris and Ankistrodesmus braunii. On the basis of the measurement of the chlorophyll luminescence spectra in suspensions of algae, it was deduced that the observable decrease of chlorophyll with sensitive algae is not directly linked to the interaction of the pigment with simazine. In the cells of the resistant species of Chlorosarcina sp., such an interaction takes place even by the second day, which apparently must be one of the reasons for the detoxification of simazine in the cells. (Holoman-Battelle)
W73-11610

A STUDY OF A SMALL TROPICAL LAKE TREATED WITH THE MOLLUSCIDE FRESCON,

Westfield Coll., London (England).

S. A. Corbet, J. Green, and E. Betney.

Environmental Pollution, Vol 4, No 3, p 193-206, April 1973. 2 fig., 8 tab., 10 ref.

Descriptors: *Pesticide toxicity, *Freshwater fish, *Molluscicides, *Invertebrates, Snails, Rotifers, Diptera, Dragonflies, Mayflies, Oligochaetes, Mites, Nematodes, Water pollution effects, Lakes, Fishkill, Mollusks, Cyanophyta, Zooplankton, Aquatic insects, Water beetles, Benthic fauna, Shrimp, Aquatic weeds, Midge.

Identifiers: *Frescon, N-tritylmorpholine, Lake Kotto, Barombi Mbo, West Cameroon, Beetles, Macroinvertebrates, Microcysts, Thermocyclops hyalinus, Chaoborus ceratopogon, Nepa, Chironomids, Hemiptera, Water mites, Ostracods, Hemichromis fasciatus, Stentor, Chromidotilapia ganthe, Loenberglia, Tilapia spp., Sarotherodon galilaeus, Barbus callipterus, Clarias walkeri, Trithemis, Ictinogomphus, Povilla adusta, Ranatra, Naja pectinata, Cardinia africana.

N-tritylmorpholine was applied, as the 16.5 percent w/v emulsifiable concentrate in tetrachloroethylene, to parts of the shores of two lakes in West Cameroon against the vectors of schistosomiasis. The concentrations of N-tritylmorpholine, with its breakdown product, triphenylcarbinol, in the lakes just after spraying ranged from 0.9 to 8.0 ppm. The treatment killed many cichlid fishes, particularly the young that live close inshore, and the higher concentrations killed or immobilized several species of aquatic insects,

crustaceans and rotifers. Ostracods and hydrcarines survived 4.8 ppm. There were no obvious long-term effects on the populations of fishes or invertebrates, probably because these animals quickly recolonize the treated beaches from unsprayed areas nearby. The use of an alternative, granular, formulation of N-tritylmorpholine may prove less harmful to fishes and invertebrates other than snails. (Little-Battelle)
W73-11614

SUBLETHAL EFFECTS OF BLEACHED KRAFT PULP MILL EFFLUENT ON RESPIRATION AND CIRCULATION IN SOCKEYE SALMON (ONCORHYNCHUS NERKA),

Fisheries Research Board of Canada, West Vancouver (British Columbia). Pacific Environment Inst.

J. C. Davis.

Journal of the Fisheries Research Board of Canada, Vol 30, No 3, p 369-377, March 1973. 6 fig., 1 tab., 31 ref.

Descriptors: *Pulp wastes, *Toxicity, *Bioassay, *Respiration, *Water pollution Effects, Fish physiology, Industrial wastes, Salmon, Lethal limit, Rainbow trout, Fish, Oxygen, Absorption, Pulp and paper industry.

Identifiers: *Oncorhynchus nerka, *Circulation (Blood), *Bleached kraft mill effluent, Median tolerance limit, Sockeye salmon, Gill, Kraft pulp mill, Ventilatory volume, Cough frequency, Oxygen utilization, Pollutant effects.

Sublethal effects of aerated neutralized, filtered, full-batch kraft mill effluent (BKME) on circulation and respiration of Pacific salmon were examined. Samples of the effluent were collected every 7-10 days from the alkaline waste sewer and sampling valves in the mill. Caustic extraction effluent was sampled along with the alkaline waste. All samples were stored, unmixed at 2°C for up to 10 days. Composite samples approximating the composition of the waste discharged into the sea were tested for toxicity using 4-day static bioassay procedures (Sprague, 1969). Ventilatory water flow, oxygen uptake, cough frequency, and buccal pressure increased in a group of 19 sockeye salmon, Oncorhynchus nerka, 207-321 g, at 10.5 plus or minus 0.5°C, upon initial exposure to sublethal BKME concentrations. The threshold concentration for these responses appeared to be around 20 percent of the 4 day LC50 (static bioassay). Following overnight exposure to BKME, ventilatory volume oxygen uptake rate, cough frequency, and oxygen utilization tended to approach pre-exposure levels, particularly at the higher sublethal concentrations. Changing effluent toxicity, acclimation phenomena, or physiological adjustment are discussed as possible explanations for these results. Measures of arterial oxygen tension in sockeye salmon indicated that arterial tension declined rapidly and remained depressed following up to 24 hr exposure to BKME (33-47 percent of 4 day LC50). On the average this decline represented a 20 percent decrease in oxygen saturation of the blood. Decreased arterial PO2 may be due to mucous production at the gills and resulting gas diffusion problems, as well as abnormalities in ventilation. Reduction in scope for activity might result from impaired oxygen uptake at the gills. A similar response was observed in rainbow trout, Salmo gairdneri. (Holoman-Battelle)
W73-11615

COPPER INDUCED LESIONS IN ESTUARINE TELEOSTS,

National Marine Water Quality Lab., West Kingston, R.I.

G. R. Gardner, and G. LaRoche.
Journal of the Fisheries Research Board of Canada, Vol 30, No 3, p 363-368, March 1973. 4 fig., 1 tab., 24 ref.

Descriptors: *Copper, *Toxicity, *Growth stages, *Bioassay, Fish diseases, Fish eggs, Juvenile fish, Larvae, Mature growth stage, Laboratory tests, Killifishes, Saline water fish, Heavy metals, Marine fish, Silversides, Cytological studies.
Identifiers: *Menidia menidia, *Fundulus heteroclitus, *Histopathology, Atlantic silverside, Mummichogs, Animal tissues, Sample preparation, Brain, Connective tissue, Olfactory organs.

The advanced fry, zygotes and adults of the mummichog, Fundulus heteroclitus, and adult Atlantic silversides, Menidia menidia, were exposed to Cu in seawater. Adult Fundulus were also exposed by means of intraperitoneal injection. The initial copper concentrations to which adult (both species) and fry were exposed in their aquatic media were 0.0, 0.5, 1.0, and 5.0 mg/liter. In the portions of the study employing external exposures, the metal was added to the media following the introduction of fish. The exposure of zygotes was at concentrations of 0.0, 0.25, 0.5, 1.0, 3.0, 5.0, and 10.0 mg/liter. The intraperitoneal injections were given to adults at concentrations of 0.0, 0.5, 1.0, 10.0, 20.0, and 100.0 mg/liter in a 0.05 ml volume of 0.7 percent saline. Cellular changes attributable to copper were observed in the mechanoreceptors of the lateral line canals in the head of adult mummichog and Atlantic silverside. The epithelium of these canals was also altered in F. heteroclitus. In both species, lesions were observed in the olfactory organs, which included the chemoreceptive sites. These manifestations of copper poisoning were evident at all studied concentrations of the metal. In M. menidia dilation of blood vessels was apparent, and in five cases hemorrhage had occurred in the brain and in periorbital connective tissues. Renal lesions in F. heteroclitus exposed to 1.0 and 5.0 mg/liter of copper were apparent; these changes could not be identified in M. menidia. Hepatic changes were not detectable by light microscopy in either species following external exposures to copper. High concentrations of copper administered intraperitoneally to F. heteroclitus did induce liver damage. Fry of F. heteroclitus were more sensitive to copper than were the adults or their zygotes. The emergence of larval forms from the zygote, the time required for emergence, and their survival were impaired by the metal. Lesions were not evident in developing sensory areas of the lateral line or the olfactory systems in these immature forms. (Holoman-Battelle)
W73-11616

RESPONSE OF LOBSTERS HOMARUS AMERICANUS TO ODOR SOLUTION IN THE PRESENCE OF BLEACHED KRAFT MILL EFFLUENT,

Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station.

D. W. McLeese.
Journal of the Fisheries Research Board of Canada, Vol 30, No 2, p 279-282, February 1973. 2 tab., 8 ref.

Descriptors: *Bioassay, *Odor, *Feeding rates, Industrial wastes, *Lobsters, Invertebrates, Water pollution effects, Crustaceans, Pulp and paper industry, Pulp wastes.

Identifiers: *Homarus americanus, *Bleached kraft mill effluent, Kraft mills, Bleach wastes, Macroinvertebrates.

Lobsters (*Homarus Americanus*) were exposed to dilute solutions of freeze-dried cod muscle extract (FDC) with and without bleached Kraft mill effluent (BKME) in flowing water runways to investigate the possible effect of BKME on feeding response. Differences between test and control responses occurred in only two of 12 comparisons when FDC was associated with 10, 50, and 100 percent BKME. With six concentrations of BKME, ranging from 0.01 to 2.0 percent, maintained in the runways, responses to FDC were variable, but average responses for controls and tests did not differ. Conditions in the latter tests

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

most closely approximated those in nature where some lobsters could be exposed continuously to low concentrations of BKME. It is concluded that exposure to low concentrations of BKME for short periods does not reduce the response of lobsters to FDC solutions or, if so, to a minor extent only. The effect of long-term exposures was not tested. (Little-Battelle)
W73-11619

EFFECTS OF A 12-HR AND 25-DAY EXPOSURE TO KRAFT PULP MILL EFFLUENT ON THE BLOOD AND TISSUES OF JUVENILE COHO SALMON (ONCORHYNCHUS KISUTCH), British Columbia Research Council, Vancouver. Div. of Applied Biology.

D. J. McLeay.
Journal of the Fisheries Research Board of Canada, Vol 30, No 3, p 395-400, March 1973. 2 tab, 28 ref.

Descriptors: *Pulp wastes, *Salmon, *Juvenile fish, *Bioassay, *Water pollution effects, Fish physiology, Industrial wastes, Toxicity, Fish diseases, Lethal limit, Laboratory tests.

Identifiers: *Histopathology, *Blood, *Animal tissues, *Hematology, Oncorhynchus kisutch, Spleen, Kidney, Gills, Thyroid gland, Liver, Glycogen, Glucose, Plasma, Unbleached white water, Median tolerance limit.

Juvenile coho salmon (*Oncorhynchus kisutch*) were exposed for periods of 12 hr and 25 days to pulp mill waste (neutralized unbleached white water) collected from the main sewer of a coastal British Columbia kraft pulp mill in order to establish the 96-hr median tolerance limit. Red blood cell counts and hematocrits of juvenile coho salmon were unaltered by 12-hr exposure to neutralized kraft pulp mill effluent, although hematocrits were decreased by exposure for 25 days. The number of circulating immature erythrocytes increased in effluent-exposed fish in both the 12-hr and 25-day exposures. The number of circulating small lymphocytes decreased markedly after 12-hr exposure. However, following the prolonged exposure, the number of small lymphocytes returned to normal, while the number of circulating neutrophils increased. The level of plasma glucose increased in fish exposed to effluent for 12 hr, and decreased in fish exposed for 25 days. Liver glycogen was not altered significantly during either exposure period. No pathological changes attributable to exposure to kraft pulp mill were observed in the tissues examined, including the spleen, kidney, gill, interrenal gland, skin epithelium, and thyroid gland. Results are discussed in terms of a stress response. (Holoman-Battelle)
W73-11620

SURVIVAL AND GILL CONDITION OF BLUEGILL (LEPOMIS MACROCHIRUS) AND FATHEAD MINNOWS (PIMEPHALES PROMELAS) EXPOSED TO SODIUM NITRILOTRIACETATE (NTA) FOR 28 DAYS, Bionomics, Inc., Wareham, Mass.

K. J. Macek, and R. N. Sturm.

Journal of the Fisheries Research Board of Canada, Vol 30, No 2, p 323-325, February 1973. 1 tab, 4 ref.

Descriptors: *Bioassay, *Toxicity, *Water pollution effects, Animal pathology, Freshwater fish, Fish diseases, Nitrilotriacetic acid, Rainbow trout, Lethal limit, Sunfishes, Minnows, Water analysis, Chemical analysis, Hardness (Water), Laboratory tests.

Identifiers: *Gills, *Lepomis macrochirus, *Pimephales promelas, *Continuous flow technique, *Sodium nitrilotriacetate, *Pollutant effects, Fathead minnow, Bluegills, Survival, Histology, Light microscopy, Continuous flow system, Median tolerance limit, Animal tissues.

The toxicity of NTA to bluegills and fathead minnows has been evaluated under conditions of 28 days' continuous exposure to measured concentrations of NTA ranging from a mean (SE) of 3.4 (0.2) to 172.8 (3.7) mg/liter. Tests were conducted in a continuous-flow proportional dilution apparatus, the flow rate of which was 6 liters/hr. During the 28-day study water samples were analyzed for NTA using the Zinc-Zinc method for sequestrant in waste and sewage (Thompson and Duthie, 1968). Gills from the exposed fish were fixed in Bouin's fixative, stained using Heidenhain's Azan technique, and examined microscopically for possible NTA-induced damage. Dynamic bioassays in soft water (35 mg/liter as CaCO₃) indicated the 96-hr median tolerance limit (95 percent confidence interval) for NTA was 98 (72-133) mg/liter for rainbow trout, and 127 (93-170) mg/liter for fathead minnow. Such a response exceeded 1000 times the mean environmental levels that might be anticipated from detergent use. A 28-day dynamic bioassay with bluegill and fathead minnows indicated a lack of cumulative toxicity associated with levels of NTA up to 1000 times expected environmental concentrations in water. Fishes exposed to 96 mg/liter NTA for 28 days exhibited no NTA-induced gill pathology. (Holoman-Battelle)
W73-11621

THE OCCURRENCE AND SEASONAL VARIATION OF TRACE METALS IN THE SCALLOPS PECTEN MAXIMUS (L.) AND CHLAMYS OPERCULARIS (L.), Marine Biological Association of the United Kingdom, Plymouth (England), Lab.

For primary bibliographic entry see Field 05A.

W73-11624

EXPERIMENTS ON THE MOVEMENT BEHAVIOR OF SINGLE-CELL FLOWING WATER ALGAE, (EXPERIMENTE ZUM BEWEGUNGSVERHALTEN VON EINZEL-LIGEN FLEISSLWASSERALGEN), Ekologiska Stationen, Mässare (Sweden).

A. Mueller-Haeckel.
Hydrobiologia, Vol 41, No 2, p 221-239, March 29, 1973. 13 fig, 1 tab, 7 ref.

Descriptors: *Diatoms, *Aquatic drift, Model studies, Flow rates, Streams, Laboratory equipment, Diurnal, Diel migration, Population.

Identifiers: *Colonization, *Repopulation, Ceratoneis arcus, Syneads minuscula, Achanthus minutissima, Monoraphidium dybowskii.

A schematic model is given of the drifting and recolonization of algal cells in an artificial channel with algal growth on the bottom when water free of algae was flowing through, as well as of the colonization of a clean channel by algal cells, when water of a brook was flowing through. Both phenomena are compared with drift and colonization in a natural channel by means of quantitative sampling. Before settling down again after drifting away, a single algal cell may cover a distance of less than 38 m. Multiple sampling over a period of 24 hours demonstrated diurnal periodicity in the drifting and colonization of various algal species from running water. (Little-Battelle)
W73-11627

DURSBAN (TRADEMARK) AND DIAZINON RESIDUES IN BIOTA FOLLOWING TREATMENT OF INTERTIDAL PLOTS ON CAPE COD - 1967-69, Bridgewater State Coll., Mass. Dept. of Chemistry.

V. M. Marganian, and W. J. Wall, Jr.
Pesticides Monitoring Journal, Vol 6, No 3, p 160-165, December 1972. 4 tab, 9 ref.

Descriptors: *Pesticide toxicity, *Diazinon, *Pesticide residues, *Gas chromatography, *Fish,

*Clams, *Crabs, *Snails, *Oysters, Persistence, Sand, Mud, Separation techniques, Phosphothioate pesticides, Chlorinated hydrocarbons, Water analysis, Massachusetts, Storage, Sampling, Salt marshes, Diptera, Tunicates. Identifiers: *Dursban, *Biological samples, Sample preparation, *Polychaetes, Hermit crab, Culicoides spp, Tabanus spp, Cleanup, Detection limits, Precision, Chemical recovery, Fundulus, Mya arenaria, Modiolus demissus, Ribbed mussel, Mud snail, Nassarius obsoletus, Marsh snail, Melampus bidentatus, Gnats, Horseflies, Leptochelia, Palaeomonetes, Uca, Sandworms, Quahog, Mercenaria mercenaria, Crassostrea virginica, Littorina littorea, Periwinkles, Fiddler crab, Carcinus maenas, Green crab, Pagurus longicarpus, Crangon, Arthropods.

Results are reported of a 3-year study (1967-69) conducted on Cape Cod, Massachusetts, to determine if the use of Dursban (Trademark) and diazinon for control of larvae of Culicoides metallifer breeding in intertidal sand, C. hollensis and C. furens breeding in salt marsh mud, and Tabanus nigrovittatus and T. lineola breeding in salt marsh sod, would result in harmful effects to nontarget organisms and to determine residue levels in the intertidal biota. Nontarget organisms sampled included oligochaetes, polychaetes, clams, oysters, mussels, snails, crabs, prawns, periwinkles, and killifishes. Analytical methods were developed which consisted of blending samples of biota, sand, mud, or water with acetonitrile and petroleum ether. Samples were extracted three times with both extractants, treated with saturated NaCl solution and distilled water. The two aqueous layers were then treated with petroleum ether, and the ether phases combined and dried. The ether extracts were concentrated with nitrogen and subjected to gas chromatographic analysis. The detection limit was 0.01 ppm; the precision was 8 percent; and recovery ranged from 80-85 percent. The results showed that 1 percent granular Dursban (Trademark) applied manually at an optimum concentration of 0.05 lb/acre controlled Culicoides larvae effectively with no noticeable harm to fiddler crabs or other organisms. Residues recovered ranged from trace amounts to 2.30 ppm in white oligochaete, 2.58 ppm in ribbed mussel, 4.62 ppm in fiddler crab, 14.0 ppm in horsefly, and 15.7 ppm in marsh snail. Two percent granular diazinon applied manually at 0.20 lb/acre controlled Culicoides effectively, but killed small sand organisms. In general, concentrations of diazinon residues recovered were higher than those for Dursban (Trademark) in the same organisms reported above. Data collected on residues in organisms at various periods after treatment and persistence periods for these pesticides in substrates of intertidal sand, salt marsh sod, salt marsh mud, and seawater are also discussed. (Little-Battelle)
W73-11627

ORGANOCHLORINE INSECTICIDES IN SURFACE WATERS IN GERMANY-1970 AND 1971, Bundesgesundheitsamt, Berlin (West Germany).

F. Herzl.
Pesticides Monitoring Journal, Vol 6, No 3, p 179-187, December 1972. 1 fig, 2 tab, 36 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Suspended solids, *Surface waters, *Chemical analysis, *Water analysis, *Pollutant identification, Insecticides, Phosphothioate pesticides, Water sampling, Methodology, DDT, DDD, DDE, Heptachlor, Dieldrin, Solvent extractions, Organophosphorus pesticides, Separation techniques, Gas chromatography.

Identifiers: *Germany, Sample preparation, Chemical recovery, Lindane, Alpha-BHC, Alpha Endosulfan, Beta-endosulfan, Parathion, Main River (Germany), Regnitz River (Germany), Rhine River, Electron capture gas chromatography, Microcoulometric gas chromatography, Detection limits, Flame ionization gas chromatography, Thin

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution—Group 5C

layer chromatography, Cleanup, Hexachlorobenzene, Metabolites, Heptachlor epoxide, Elbe River, Weser River, Danube River, Ems River (Germany), Ruhr River (Germany), Sieg River (Germany), Lahm River (Germany), Moselle River (Germany), Lake Constance (Germany), Saale River (Germany), Havel River (Germany), Neckar River (Germany), Mittelland-Kanal (Germany), Nord-Oste-Kanal (Germany), Teltow Kanal (Germany).

As part of a series of studies initiated in 1969 to determine the organochlorine insecticide content of major waters in the Federal Republic of Germany, unfiltered water and suspended solids were analyzed from approximately 25 sites sampled in May 1971, and unfiltered water was analyzed from 7 sites sampled monthly from April 1970-June 1971. As in former studies (June and October 1969, April and September 1970), the insecticide concentrations found in waters and suspended solids were almost exclusively in the ppt range (ng/liter). The compounds found most frequently were gamma-BHC (lindane) and alpha-BHC; alpha and beta-endosulfan were detected in the Main, Regnitz, and Rhine Rivers. DDT and particularly its metabolites DDD and DDE were found infrequently except in samples from the Berlin-Teltowkanal. Findings of heptachlor, heptachlor epoxide, dieldrin, and parathion (the only organophosphorous insecticide included in the study) were rare. (Holoman-Battelle)

W73-11628

SPRING PHYTOPLANKTON ABUNDANCE AND PRODUCTIVITY IN GRAND TRAVERSE BAY, LAKES MICHIGAN, 1970,
Michigan Univ., Ann Arbor. Great Lakes Research Div.

For primary bibliographic entry see Field 05B.

W73-11629

THE BACTERIOLOGY OF THE WATER SUPPLIES OF RANGOON: II. COOL DRY AND HOT DRY SEASONS,

Institute of Medicine (I), Rangoon (Burma). Dept. of Microbiology.

K. Sann-Myint, M. Tu, and H. Chen.

Union Burma J Life Sci. Vol 3, No 2, p 181-190, 1970. Illus.

Identifiers: Alcaligenes-Faecalis, Bacteriology, Burma (Rangoon), Citrobacter-Freundii, "Coliform count, Clostridium-Perfringens, Enterobacter, E. Coli, Hot, Klebsiella-Aerogenes, Proteus-Mirabilis, Proteus-Vulgaris, Pseudomonas-Aeruginosa, Pseudomonas-Fluorescens, Staphylococcus-Epidermidis, Streptococcus-Faecalis, "Water supply.

Water samples from 19 piped and natural sources in Rangoon were examined bacteriologically during the cool dry season of 1966-67 and the hot dry season of 1967 for the Presumptive Coliform Count, the Presumptive Enterococci Count and the presence of Presumptive Clostridium perfringens. Bacteria isolated from MacConkey bile salt lactose peptone water and sodium azide medium primary cultures were identified. Using as criterion the Presumptive Coliform Count and the isolation of Escherichia coli and/or Klebsiella aerogenes and/or Streptococcus faecalis, for the cool dry season, all of the 15 samples tested were found unsatisfactory for drinking purposes. Again, for the cool dry season, all of the 16 samples tested were found unsatisfactory. The bacteria isolated were E. coli, K. aerogenes, Citrobacter freundii, Enterobacter spp., Alcaligenes faecalis, Proteus mirabilis, P. morganii, P. vulgaris, Pseudomonas aeruginosa, P. fluorescens, Staphylococcus epidermidis and S. faecalis. At room temperature, in the coliforms, E. coli and K. aerogenes were viable up to 140, and C. freundii (1 strain) up to 14 days. At 4°C, K. aerogenes, C. freundii (1 strain) and/or Enterobacter sp. (1 strain) were viable for 56, 14, and 7 days, respectively, and in the non-

coliforms, P. mirabilis and P. morganii for 14, P. vulgaris (1 strain) for 28, and P. fluorescens for 56 days.—Copyright 1972, Biological Abstracts, Inc. W73-11630

STUDIES ON SCHISTOSOMIASIS IN MEKONG BASIN: II. MALACOLOGICAL INVESTIGATIONS ON HUMAN SCHISTOSOMA FROM LAOS,

National Taiwan Univ., Taipei. Dept. of Parasitology.

C. T. Lo, E. G. Berry, and T. Iijima. Chin J Microbiol. Vol 4, No 3/4, p 168-181, 1971. Illus.

Identifiers: "Lao (Mekong basin), "Malacological studies, "Mekong river basin, Oncomelania-Huensis-Chui, Oncomelania-Huensis-Formosana, Oncomelania-Huensis-Huensis, Oncomelania-Huensis-Nosophora, Oncomelania-Huensis-Quadrasi, Pachydorbia-Bavayi, Pomatiopsis-Lapioaria, Schistosoma, "Schistosomiasis, Tricula-Shini.

A snail survey was made in the area of Khong Island, Laos, from Dec. 1968 to Jan. 1969 to determine the molluscan host of human Schistosoma. A total of 13,269 snails from 10 spp. of operculates were examined for larval trematodes, and 26 types of larvae, including 6 furciferous cercariae, were found. Three of the furciferous cercariae were given to laboratory mice but the infection was negative, indicating that none of them were human schistosomes. Oncomelania huensis huensis, O. h. nosophora, O. h. quadrasi, O. h. formosana, O. h. chui, Pomatiopsis lapidaria, Pachydorbia bavayi and Tricula shini were experimentally exposed to miracidia of Schistosoma originating from Laos, but cercariae were not obtained. P. bavayi in the family Hydrobiidae occurred in abundance in the Mekong River, and was suspected to be a likely snail host for the human Schistosoma in the area. Miracidia of the Laotian Schistosoma and the Japanese strain of S. japonicum penetrated successfully into this snail, but the life cycle of the parasite was not yet experimentally completed. More snails probably become infected during the early rainy season (April-June) and more snails probably shed cercariae from June-Aug. The Mekong River seems to be the major site of infection for both humans and snails.—Copyright 1972, Biological Abstracts, Inc. W73-11633

POLLUTION EFFECTS ON PHYCOVIRUS AND HOST ALGAE ECOLOGY,

Delaware Univ., Newark. Dept. of Biological Sciences.

M. S. Shane, R. E. Cannon, and E. DeMichele. Journal Water Pollution Control Federation, Vol 44, No 12, p 2294-2302, December 1972. 4 fig, 4 tab, 9 ref. OWRR-A-016-DEL (3).

Descriptors: "Bioindicators, "Cyanophyta, "Water pollution, "Water pollution sources, "Ecological distributions, "Hosts, "Water pollution effects, Chemical analysis, Plant viruses, Aquatic algae, "Delaware, Water sampling, Water analysis, Aquatic plants, Water chemistry, Water temperature, Alkalinity, Turbidity, Coliforms, Biochemical oxygen demand, Chemical oxygen demand, Oxygen demand, Dissolved oxygen, Zinc, Phosphates, Nitrates, Nitrites, Ammonia, Heavy metals, Hardness (Water), Iron, Chromium.

Identifiers: "Phycoviruses, Lyngbya, Plectonema boryanum, "Christina River (Del), Phormidium, Most probable number test, LPP viruses.

Chemical, physical, and biological parameters of pollution were measured at 11 stations along the Christina River (Delaware) which were located from source to mouth. The purpose was to determine the distribution of Lyngbya, Phormidium, and Plectonema viruses in relationship to pollution. Biochemical oxygen demand, chemical ox-

ygen demand, dissolved oxygen, phosphate, nitrate-, nitrite-, NH₃-nitrogen, heavy metals, hardness, pH, temperature, alkalinity, turbidity, and coliform data are reported. These data give strong indications that Lyngbya, Phormidium, and Plectonema viruses are associated with cultural pollution. (Holoman-Battelle)

W73-11635

IDENTIFICATION OF THE CONSTITUENTS OF KRAFT PULPING EFFLUENT THAT ARE TOXIC TO JUVENILE COHO SALMON (ON-CORBYNCHUS KISUTCH),
British Columbia Research Council, Vancouver. For primary bibliographic entry see Field 05A. W73-11638

PLANKTONIC CHANGES FOLLOWING THE RESTORATION OF LAKE TRUMEN, SWEDEN,
Lund Univ. (Sweden). Limnology Inst. For primary bibliographic entry see Field 05G. W73-11639

THE ROLE OF NITROGEN IN THE AQUATIC ENVIRONMENT,

Academy of Natural Sciences of Philadelphia, Pa. Dept. of Limnology.

D. M. Martin, and D. R. Goff. Available from the National Technical Information Service as PB-213 496, \$3.00 in paper copy, \$0.95 in microfiche. Report No. ANSP-CLDP-2, 1972. 46 p, 2 fig, 2 tab, 78 ref.

Descriptors: "Nitrogen, "Nutrients, "Aquatic environment, "Eutrophication, "Cycling nutrients, "Nitrogen cycle, Nitrogen fixation, Water pollution sources, Nitrogen compounds, Toxicity, Absorption, Water quality standards, Path of pollutants, Trophic level, Groundwater, Lakes, Oceans, Industrial wastes, Municipal wastes, Denitrification, Nitrification, Chemical reactions, Urban runoff, Farm wastes, Ion exchange, Biological treatment, Reverse osmosis, Methodology, Aquatic plants, Cations, Nitrates, Nitrites, Septic tanks, Drainage, Precipitation (Atmospheric), Geologic formations, Weathering, Decomposing organic matter, Scale, Water quality control, Ammonia, Chlorination, Anions.

Identifiers: "Biodegradation, Pollutant removal, Ammonia stripping, Denitrification rates.

A comprehensive, up-to-date overview is presented of the significance and interactions of various nitrogen compounds within the aquatic environment. Sections are included on nitrogen occurrence (flowing water, ground water, lakes, oceans); mechanics of transformation, uptake and release; sources, toxicity, methods of treatment for removal; and association with eutrophication and water quality standards. The term 'Eutrophication' has been very loosely used in the past. One of the common results of increased nitrogen loading, especially in water-bodies known to previously have had limited biological productivity due to nitrogen deficiencies is, 'Eutrophication.' However, the authors caution against predictive generalization about the response of plants to any single nutrient applicable to all situations. Many factors such as turbidity, predator pressure, thermal effects and availability of complementary nutrients may be overriding in any given situation. To single out for removal any one nutrient, or to recommend a specific treatment method applicable to all situations is not realistic. (Holoman-Battelle)

W73-11640

SMITHSONIAN ADVISORY COMMITTEE REPORT ON STUDIES OF THE EFFECTS OF WASTE DISPOSAL IN THE NEW YORK BIGHT,

Smithsonian Institution, Washington, D.C. Oceanography and Limnology Program.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

M. A. Buzas, J. H. Carpenter, B. H. Ketchum, J. H. McHugh, and V. J. Norton.

Available from the National Technical Information Service as AD-746 960, Report, July 1972. 60 p, 3 append. Contract No. DAWC 72-70-C-0016.

Descriptors: *Water pollution effects, *Water pollution control, *Water quality, *Sludge disposal, *Reviews, Heavy metals, Coliforms, Benthos, Zooplankton, Amphipoda, Fish, Sampling, Copepods, Turbidity, Suspended solids, Waste disposal, Water temperature, Salinity, Sediments, Phosphorus, Phosphates, Nitrates, Iron, Dissolved oxygen, Zinc, Molybdenum, Manganese, Copper, Aluminum, Lead, Chromium, Mercury, Biomass, Statistical methods, Sewage sludge, Clams, Lobsters.

Identifiers: *New York Bight, Data interpretation, Orthophosphates, Chlorophyll a, Boron, Barium, Strontium, Foraminifera, Dredge spoils, Species diversity, Macroinvertebrates, Quahog.

Reports of studies by the U.S. Army Coastal Engineering Research Center on the effects of waste disposal in the New York Bight were reviewed. The reviews point out shortcomings in the data which prevent drawing definite conclusions about the effects of waste disposal and suggest areas for further research which will overcome this deficiency. Recommendations are included regarding further research on this area and on dumping practices. The major recommendation on disposal is that acceptable alternatives should be sought but in the meantime more effective management and control must be instituted. (Little-Battelle) W73-11642

CYCLING OF ELEMENTS OF ESTUARIES,
National Marine Fisheries Service, Beaufort, N.C.
Atlantic Estuarine Fisheries Center.

For primary bibliographic entry see Field 05B.

W73-11645

INFLUENCE OF LEAD AND OTHER METALS ON FISH DELTA-AMINO-LEVULINATE DEHYDRASE ACTIVITY,
National Marine Water Quality Lab., West Kingston, R.I.

For primary bibliographic entry see Field 05A.

W73-11646

RECOVERY OF SALT MARSH VEGETATION FROM SUCCESSIVE OIL SPILLAGES,
Field Studies Council, Pembroke (England). Oil Pollution Research Unit.

J. M. Baker.

Environmental Pollution, Vol 4, No 3, p 223-230, April 1973. 5 fig, 1 tab, 2 ref.

Descriptors: *Oil spills, *Dominant organisms, Salt marshes, Aquatic plants, Oil pollution, Water pollution effects, Toxicity, Estuarine environment, Grasses, Marsh plants.

Identifiers: *Recovery, Spartina anglica, Puccinellia maritima, Juncus maritimus, Bogrush, Rushes, Alkali grass, Cordgrass.

Field experiments involving different numbers of successive oilings with Kuwait crude were carried out on three types of salt marsh vegetation (Spartina anglica, Puccinellia maritima, Juncus maritimus) in 1968. Recovery from up to four oilings was generally good, but considerable changes resulted from eight and twelve oilings. Changes in species dominance or exposure of bare mud persisted in 1972, indicating that recovery was likely to be very slow. (Little-Battelle) W73-11649

SMALL-SCALE EXPERIMENTS TO DETERMINE THE EFFECTS OF CRUDE OIL FILMS ON GAS EXCHANGE OVER THE CORAL BACK-REEF AT HERON ISLAND.
D. W. Kinsey.

Environmental Pollution, Vol 4, No 3, p 167-182, April 1973. 5 fig, 1 tab, 12 ref, 2 append.

Descriptors: *Oil spills, *Reefs, *Toxicity, Dissolved oxygen, Carbon dioxide, Water pollution effects, Oil pollution, Water temperature, Hydrogen ion concentration, Alkalinity, Salinity, Wind velocity, On-site investigations, Sea water, Marine animal, Pacific Ocean, Respiration.

Identifiers: *Gas exchange, Moonie crude oil, Crude oil, Heron Island, Australia.

A coral reef at Heron Island which is subjected to low-tide slack water conditions, was fenced with steel posts, fencing wire, and acetate-covered wire mesh for investigation of the effect of oil slicks on gas exchange. Three tests were conducted during low tides: (1) Control with no oil film; (2) with an oil film of about 0.1 mm thickness; and (3) with an oil film of about 0.7 mm thickness. Moonie crude oil was used in the experiments. Oxygen levels, temperature, pH, alkalinity, salinity, and wind speed were measured. Carbon dioxide was calculated from other data. The following points were indicated: (1) Films as thin as 0.1 mm caused considerable calming of the water surface; (2) Under conditions of light wind, films of 0.1 mm and 0.7 mm nominal thickness caused no significant interference with oxygen and carbon dioxide transfer through the water surface other than that associated directly with the calming effect. Respiration of the reef community remained normal (3) A 0.1 mm film of the heavier residual oil left after prolonged exposure of the fresh crude may have given some slight interference with gas transfer but it is more probable that this effect was an artifact to temperature; (4) No toxicity effects or abnormal behavior patterns were observed over the time periods used (5) More information is required on the effects of dead calm weather, higher temperature, thicker and more viscous oil films, and longer periods of exposure. (Little-Battelle) W73-11650

LOW PH VALUES SHOWN TO AFFECT DEVELOPING FISH EGGS (BRACHYDANIO RERIO HAM.-BUCH.),
Uppsala Univ. (Sweden). Inst. of Zoophysiology. N. Johansson, J. E. Kihlstrom, and A. Wahlberg. AMBIO, Vol 2, Nos 1/2, p 42-43, February 1973. 4 fig, 11 ref.

Descriptors: *Water pollution effects, *Hydrogen ion concentration, *Bioassay, *Fish eggs, *Hatching, *Sulfur compounds, Air pollution, Path of pollutants, Water pollution sources, Fish reproduction, Toxicity, Freshwater fish.

Identifiers: *Survival, Zebrafish, Brachydanio rerio.

Since the acidity of lakes and rivers in northwestern Europe has been increasing, purportedly due to emission of sulfur compounds into the atmosphere from burning fossil fuel, tests were conducted with zebrafish eggs to determine the effects on fish populations. Eggs were collected and reared at 25 °C in petri dishes containing water at pH ranges of 4.0 to 10.0. Dead and hatched eggs were counted daily. About 2100 eggs were studied. The frequency of hatching decreased from about 50 percent at pH 7 to about four percent at pH 4, the young embryos being the most sensitive to the acid water. There was also a tendency towards a prolongation of the period from fertilization to hatching at low pH values. In slightly alkaline solutions the frequency of hatching remained unchanged, but there was a slight shortening of the period from fertilization to hatching. (Little-Battelle) W73-11651

SUBLETHAL EFFECTS OF BALTIMORE HARBOR WATER ON THE WHITE PERCH,

MORONE AMERICANA, AND THE HOGCHOKER, TRINECTES MACULATUS,
Maryland Univ., Solomons Natural Resources Inst.

R. P. Morgan, II, R. F. Fleming, V. J. Rasin, Jr., and D. R. Heinle.

Chesapeake Science, Vol 14, No 1, p 17-27, March 1973. 1 fig, 5 tab, 27 ref.

Descriptors: *Fish physiology, *Bioassay, *White perch, *Heavy metals, *Dielectric, *Enzymes, Cadmium, Chromium, Copper, Iron, Mercury, Zinc, Water pollution effects, Marine fish, Sea basses, Laboratory equipment, Industrial wastes, Domestic wastes, Toxicity.

Identifiers: *Baltimore Harbor, *Hogchokers, *Histology, Morone americana, Trinectes maculatus, Roccus americanus, Patuxent River, Biological samples, Sample preparation, Blood, Tissue, Brain, Liver, Gills, Kidney, Muscle, Fat, Thrombocyte, Neutrophil, Basophil, Lactate dehydrogenase, Acetylcholinesterase, Lymphocyte.

Possible sublethal effects of Baltimore Harbor Water, which receives various industrial and domestic wastes, were investigated in bioassays with white perch and hogchokers. The tests were conducted in 170-liter polyethylene tanks containing full-strength Harbor water, half-strength Harbor water and water from the Patuxent River. Exposures were for 14 to 30 days for white perch and 7 to 28 days for hogchokers. After exposure, blood samples were collected for differential staining and bodies were dissected for enzyme, histology, heavy metal, and pesticide analyses. There were no significant variations in Cd, Cr, Cu, Fe, Hg, and Zn in the three tests. Dielectric was the only pesticide found and variations were slight among the tests. However, physiological effects of Baltimore Harbor water included changes in thrombocyte, neutrophil, and basophil levels in white perch. Biochemical effects included increased LDH activity in the serum of white perch and hogchokers when exposed to Baltimore Harbor water, decreased acetylcholinesterase activity in white perch and hogchoker brains, and decreased catalase levels of the liver of both white perch and hogchokers. Sublethal effects were noted at the longer (28 and 30 day) exposures to the Baltimore Harbor water. (Little-Battelle) W73-11652

TEMPERATURE EFFECTS ON MERCURY ACCUMULATION, TOXICITY, AND METABOLIC RATE IN RAINBOW TROUT (SALMO GAIRDNERI),
Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.

J. C. MacLeod, and E. Pessah.

Journal of the Fisheries Research Board of Canada, Vol 30, No 4, p 485-492, April 1973. 5 fig, 4 tab, 24 ref.

Descriptors: *Mercury, *Toxicity, *Rainbow trout, *Bioassay, Juvenile fish, Fish physiology, Heavy metals, Water temperature, Fry, Animal metabolism, Chemical analysis, Mortality, Water pollution effects, Laboratory tests.

Identifiers: *Bioaccumulation, *Metabolic rates, *Biological magnification, Median tolerance limit, Mercuric chloride, Phenylmercuric acetate, Animal tissues, Muscle, Organomercury compounds, Wet digestion, Flameless atomic absorption spectrophotometry, Bone, Skin.

Hatchery-reared rainbow trout fingerlings were exposed to 5 concentrations of mercury (mercuric chloride and phenylmercuric acetate) at each of three temperatures (5, 10, and 20 °C) in aquaria. Each aquarium was divided into 2 compartments, one holding 10-15 fish for assessing mortality and the other, 6 fish for Hg residue determinations in their flesh. Two fish were removed after 6, 24, and 96 hr of exposure, frozen whole and later thawed and weighed. The muscle, bones and skin were

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Waste Treatment Processes—Group 5D

analyzed for total Hg by a wet digestion and flameless atomic absorption spectrophotometric method. Active metabolism determinations were made in respirometer flasks equipped with magnetic stirrers. Mercury toxicity was related to temperature and chemical formulation of the mercury. At 10°C, the 24-hr TL₅₀ concentration (median tolerance limit) for mercuric chloride (HgCl₂) was approximately 30 times that for phenyl mercuric acetate (PMA). The 96-hr TL₅₀ values for mercuric chloride at 5, 10, and 20°C were 0.40, 0.28, and 0.22 mg Hg/liter. The velocity of mortality, (V equals reciprocal of time to death in hours), was linearly related to temperature. For a mercuric chloride concentration of 0.5 mg Hg/liter, V equals 0.002 plus 0.0023t, where t equals temperature in centigrade degrees. Temperature also affected accumulation rate of mercury in the fish muscle. At 5, 10, and 20°C a mercuric chloride concentration of 0.1 mg Hg/liter in the water produced biological magnification factors (conc. in fish divided by conc. in water) of 4, 10, and 22 times, respectively. PMA produced higher magnification factors of 80-100 times at 10°C. Active metabolic rate, though increased by higher temperatures, was depressed by mercuric chloride, and higher temperatures augmented the depressant effect. (Holoman-Battelle) W73-11655

EFFECTS OF SUBLETHAL CONCENTRATIONS OF SODIUM PENTACHLOROPHENATE ON GROWTH RATE, FOOD CONVERSION EFFICIENCY, AND SWIMMING PERFORMANCE IN UNDERYEARLING SOCKEYE SALMON (ONCORHYNCHUS NERKA).

Fisheries Research Board of Canada, Nanaimo (British Columbia), Biological Station.

P. W. Webb, and J. R. Brett.

Journal of the Fisheries Research Board of Canada, Vol 30, No 4, p 499-507, April 1973. 7 fig, 1 tab, 19 ref.

Descriptors: *Sockeye salmon, *Phenolic pesticides, *Growth rates, *Bioassay, *Pesticide toxicity, Juvenile fish, Fish physiology, Fish behavior, Water pollution effects, Bactericides, Herbicides, Laboratory tests, Insecticides, Smolt, Lethal limit, Chlorinated hydrocarbon pesticides, Dissolved oxygen, Water temperature, Hydrogen ion concentration, Animal metabolism, Stress.

Identifiers: *Food conversion efficiency, *Sodium pentachlorophenate, Data interpretation, Oncorhynchus nerka, Median tolerance limit, Pentachlorophenol.

Two response systems, swimming speed and growth (along with food conversion efficiency) have been used as indicators of stress from sublethal concentrations of sodium pentachlorophenate. Tests were performed at 15°C, pH 6.8, and dissolved oxygen values of 90-100 percent air saturation. Growth rate and conversion efficiency were measured by feeding a ration level of 15 percent body dry weight/day to underyearling sockeye salmon (Oncorhynchus nerka) held at sodium pentachlorophenate (PCP) concentrations of 0, 1.14, 1.99, 3.49, 7.16, 13.60, 27.73, 31.57, and 47.18 ppb. Swimming performance was measured at PCP concentrations of 0, 7.21, 19.00 and 50.00 ppb. The 96-hr LC₅₀ was 63 ppb PCP. Growth rate and conversion efficiency were almost equally affected by PCP, the EC₅₀ values being 1.74 for ppb for growth rate and 1.80 ppb for conversion efficiency. This is approximately 2.8 percent of the 96-hr LC₅₀. Swimming performance was unaffected by PCP at the concentrations used. (Holoman-Battelle) W73-11656

THE NEED FOR HYDROGEOLOGIC EVALUATIONS IN A MINE DRAINAGE ABATEMENT PROGRAM: A CASE STUDY, TOMS RUN, CLARION COUNTY, PENNSYLVANIA,

Pennsylvania Dept. of Health, Harrisburg, Bureau of Sanitary Engineering.

For primary bibliographic entry see Field 05G.

W73-11674

INFLUENCE OF AGRICULTURAL PRACTICES ON WATER QUALITY IN NEBRASKA: A SURVEY OF STREAMS, GROUNDWATER, AND PRECIPITATION.

Nebraska Univ., Lincoln. Dept. of Agronomy. For primary bibliographic entry see Field 05B. W73-11696

5D. Waste Treatment Processes

CANNERY WASTEWATER TREATMENT WITH ROTATING BIOLOGICAL CONTACTOR AND EXTENDED AERATION,

Pacific Northwest Environmental Research Lab., Corvallis, Oreg.

M. W. Cochrane, R. J. Burn, and K. A. Dostal. Copy available from GPO Sup Doc as EP1.23/2-73-024, \$0.90; microfiche from NTIS as PB-221 333, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-024, April 1973. 62 p, 11 fig, 13 tab, 10 ref. EPA Project 12060.

Descriptors: *Waste water treatment, Water pollution control, *Industrial wastes, *Canneries, *Biological treatment, Aerobic treatment, *Aeration.

Identifiers: *Extended aeration, *Rotating biological contactor.

Fruit and vegetable cannery wastewater was treated during two canning seasons by two pilot plants of the rotating biological contactor (RBC) and extended aeration types. The objective was to determine the effectiveness of these biological treatments processes on cannery wastewater and to compare the two units under the same operating conditions. Nitrogen and phosphorus were added to the influent wastewater so the BOD:N:P ratio was kept above 100:5:1. Both treatment units attained organic removals of over 90%. However, much less detention time was necessary in the RBC to obtain removals comparable to the extended aeration plant. Sludge produced by the RBC required additional treatment, but most of the sludge produced in the extended aeration plant was aerobically digested in the aeration tank. Effluent quality from both units was about the same over the operating temperature range of 10-20°C, although the RBC appeared to recover more rapidly from organic shock loading. Neither unit produced an effluent that could be discharged to surface waters without further treatment. (EPA) W73-11058

MARINE SANITATION SYSTEM DEMONSTRATION,

Delaware River and Bay Authority, New Castle. E. L. Kaminsky, W. F. Roberts, and J. C. Volk, Jr. Copy available from GPO Sup Doc as EP1.23/2-73-226, \$1.25; microfiche from NTIS as PB-221 334, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-226, May 1973. 105 p, 25 fig, 29 tab, 2 ref. EPA Project 15020 GYM.

Descriptors: *Activated carbon, *Chlorination, Treatment, *Recycling, *Waste water treatment, Tertiary treatment, *Environmental sanitation.

Identifiers: *Marine sanitation system.

A 'flow-through' physical-chemical marine sanitation system capable of providing a high degree of secondary treatment was successfully demonstrated in the laboratory and on board the Delaware River and Bay Authority's Cape May-Lewes Ferry. Effluent performance goals of suspended solids and BOD₅ less than 50 mg/l and coliform bacteria count less than 240 MPN/100 ml were met. Following promulgation of the Environmental Protection Agency's 'No Discharge' standard, the system (without the addition of any treat-

ment processes) was also tested in a recycle mode by recycling the treated effluent for toilet flushing purposes. On the first recycle day, the suspended solids and BOD₅ remained at the 'flow-through' levels. With each succeeding day the suspended solids increased only slightly, but the BOD₅ increased to values ranging between 140 and 400 mg/l. Coliform bacteria count was less than 10 MPN/100 ml. The color of the recycled water changed from clear to a gray milky appearance. A noticeable ammonia odor appeared on the second day. Ammonia nitrogen levels were in the 50-460 range. The ammonia can be removed by air stripping or breakpoint chlorination, and the increased BOD₅ levels can be reduced by chemical oxidation. (EPA) W73-11059

STEAM STRIPPING ODOROUS SUBSTANCES FROM KRAFT EFFLUENT STREAMS (SEKOR),

Washington Univ., Seattle.

B. F. Hrutford, L. N. Johanson, and J. L. McCarthy.

Copy available from GPO Sup Doc as EP1.23/2-73-196, \$1.25; microfiche from NTIS as PB-221 335, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-196, April 1973. 81 p, 9 fig, 24 tab, 10 ref. EPA Project 12040 EXQ.

Descriptors: Steam, *Pulp wastes, Pollution abatement, Water reuse, Recovery, Odor, Sulfur compounds, Organic compounds, *Waste water treatment.

Identifiers: *Steam stripping, Pulp condensates, *Volatiles, Terpenes, Methyl mercaptan, Methanol, Trupentine, *Odor control, Black liquor.

Laboratory and design studies have been completed relating to volatile constituents which appear in Kraft black liquor and condensate streams, and how these can best be removed and recovered. In order of decreasing concentration the volatile constituents are alcohols, terpenes, ketones, sulfur bearing compounds, and phenolic compounds. Methanol, the major alcohol contaminant, is found in from 280 to 8400 ppm in condensate streams, amounting to 11 to 16 pounds per ton of pulp produced. Terpenes are found to range from a few ppm to about 4500 ppm in condensates, 4 to 9 pounds per ton of pulp. Acetone is present at concentrations of 2 to 200 ppm, corresponding to 0.07 to 0.4 pounds per ton of pulp. In all, some 40 compounds were present in condensate streams. The feasibility of combining steam stripping of Kraft liquor with steam stripping of condensates was explored, and the conditions under which this may be warranted are reported. Under most present mill situations, steam stripping of black liquor and the last stages of evaporator condensates does not appear to be warranted except in unusual cases. Exploratory type studies were made and are reported concerning improved methods of predicting vapor-liquid equilibria in such systems, and separation of the resulting volatile oils. (EPA) W73-11060

AEROBIC SECONDARY TREATMENT OF PLYWOOD GLUE WASTES,

Columbia Plywood Corp., Portland, Oreg.

J. L. Graham.

Copy available from GPO Sup Doc as EP1.23/2-73-195, \$2.90; microfiche from NTIS as PB-221 338, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-195, April 1973. EPA Project 12100 EZU.

Descriptors: *Waste water treatment, *Industrial wastes, *Aerobic treatment, *Activated sludge, Biological treatment, Wood wastes, Tertiary treatment, *Oregon, Biochemical oxygen demand.

Identifiers: *Plywood glue wastes, Tube settler, Klamath Falls (Ore).

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

An activated sludge treatment system, consisting of an aeration tank, a tube-settler clarification module and a waste solids lagoon, was constructed at Klamath Plywood Corporation in Klamath Falls, Oregon to treat urea-formaldehyde glue and steam vat condensate waste-water. Operation of the system was studied over a period of 18 months. Prior to operation of the system, several in-plant changes were made to reduce the flow and BOD loading. The flow to the treatment system was reduced from about 40,000 gallons per day to about 8,000 gallons per day and BOD from 500-1,000 pounds per day to 100-400 pounds per day. During the period of greatest efficiency, the flow averaged 6,700 gallons per day and the BOD averaged 182 pounds per day. The results indicate that activated sludge treatment of urea-formaldehyde glue waste alone is not feasible (average BOD removal of 8 percent). The combined wastewater is amenable to treatment by activated sludge, but requires the addition of phosphorus. Without nutrient addition, the average BOD removal was 38 percent. During the period when phosphorus was added to the system, the BOD removal averaged 78 percent. The flow averaged 9,800 gallons per day during the latter period. Treatment efficiency was adversely affected by cold weather during part of the study period. (EPA).

W73-11065

SOLVENT EXTRACTION STATUS REPORT, Robert S. Kerr Water Research Center, Ada, Okla.

L. F. Mayhue.

Copy available from GPO Sup Doc as EPI.23/2-72-073, \$0.75; from NTIS as PB-221 458, \$2.75 in paper copy, \$0.95 in microfiche. Environmental Protection Agency, Technology Series Report EPA-R2-72-073, December 1972. 38 p, 6 fig, 1 tab, 24 ref. EPA Project 12020 EWZ.

Descriptors: *Solvent extractions, *Separation techniques, Desalination processes, Solubility, Solvents, *Waste water treatment, Tertiary treatment, *Water reuse, Water allocation, Immiscibility, Industrial wastes, *Reviews.

Identifiers: Solvent solubility, Solvent selectivity, Liquid extraction contactors.

The history, basic principles, process application, laboratory approach, and grant program concerning solvent (liquid-liquid) extraction was investigated in relation to its application to industrial effluent waste water systems. A search of the literature reveals that little consideration has been given to solvent extraction as a feasible waste treatment method. Various aspects of solvent extraction technology are presented along with a number of industrial wastes which should be considered for treatment. One of the areas of greatest need for research concerning industrial waste water treatment is in the removal of refractory, taste and odor causing compounds. Application of solvent extraction to waste systems containing low concentrations (0.05%) may be feasible on a "swap out" basis or in conjunction with biological, adsorption, or incineration treatments as a pretreatment step. Application of solvent extraction to waste systems for recovery of salable products to offset cost of treatment should be studied for feasibility. Accomplishments and plans regarding industrial research projects are presented. (EPA)

W73-11066

OXIDATION OF PYRITES IN CHLORINATED SOLVENTS, NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.

J. A. Boros, D. R. Brennenman, and J. C. Troy.

Copy availabNo. le from GPO Sup Doc as EPI.23/2-72-069, \$1.00; microfiche from NTIS as PB-214 455, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-72-069, November 1972. 52 p, 11 fig, 11 tab, 20 ref. EPA Project 14010 FMM, Contract 14-12-897.

Descriptors: *Pyrites, *Chlorination, *Coal mine wastes, *Iron compounds, *Sulfur compounds, Waste dumps, Ultimate disposal, Acid mine water, Water pollution sources, Sulfides, Pollution abatement, Waste water treatment.

Identifiers: *Non-aqueous chlorination, Chlorinated solvents.

The purpose was to develop methods for extracting sulfur and iron compounds from pyritic waste materials, producing a final refuse that is incapable of causing water pollution, and at the same time, conserving useful mineral resources. The primary method under investigation was the chlorination of pyrites in non-aqueous solvents. An attractive feature of the proposed method was its cyclic nature. Chlorine would serve as the original driving force for the expected reactions, but would be replaced as primary oxidant by two products of the chlorination reaction, ferric chloride and sulfur dichloride. Test results indicated that the successful extraction of sulfur and iron compounds depended upon the continuous addition of chlorine gas to the system. The expected replacement of chlorine by ferric chloride and sulfur dichloride was not achieved under conditions of this study. The reaction rates with chlorine gas varied with the particle size and source of the pyritic material; with the choice of solvent; and with the means of providing intimate contact between pyrites and chlorine-saturated solvents. Recycling solvents through beds of pyrite significantly improved rates of reaction, while elevated temperatures and treatment in the presence of ultra-violet radiation yielded slight improvements in reaction rate. (EPA)

W73-11068

CHARACTERIZATION OF THE ACTIVATED SLUDGE PROCESS, Los Angeles Bureau of Sanitation, Calif.

R. D. Bargman and J. Borgerding.

Copy available from GPO Sup Doc as EPI.23/2-73-224, \$0.95; microfiche from NTIS as PB-221 340, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-224, April 1973. 63 p, 29 fig, 6 tab, 6 ref. EPA Project 17090 FJU, Contract 14-12-148.

Descriptors: *Activated sludge, *Kinetics, Model studies, *Waste water treatment, Measurement, Operations, Control, Mathematical models, California, Aeration, Sewage treatment, Settling basins, Sewage, Sewage effluents, Treatment facilities.

Identifiers: Hyperion, Time dependent, *Phosphorus removal, BOD removal, Sludge production, Technicon.

Operational control parameters of the activated sludge process during steady-state and transient flow conditions were evaluated and related to carbon, nitrogen, and phosphorus removals. During steady-state testing, chemical oxygen demand, net growth rate, aeration tank detention time, and final settling tank detention time were found to be the key operational control parameters. Changes in COD removal and suspended solids removal were found to be proportional to a change in control parameter. Nitrogen removal was related to specific operational parameters and system nitrogen balances were computed. Phosphorus removal without external chemical addition was related to specific operational parameters. (Smith-EPA)

W73-11069

DEVELOPMENT AND PRELIMINARY DESIGN OF A SORBENT-OIL RECOVERY SYSTEM, Hydronautics, Inc., Laurel, Md.

For primary bibliographic entry see Field 05G.
W73-11071

THE NORTHERN MAINE REGIONAL TREATMENT SYSTEM, Northern Maine Regional Planning Commission, Presque Isle.

J. A. Barresi, J. Gammon, and R. E. Hunter.

Copy available from GPO Sup Doc as EPI.23/3-73-013, \$3.45; microfiche from NTIS as PB-221 346, \$0.95. Environmental Protection Agency, Socioeconomic Environmental Studies Series Report EPA-R5-73-013, April 1973. 333 p, 68 fig, 149 tab, 41 ref. EPA Project 16110 DPT. R and D, Feb 1971-Dec.

Descriptors: *Regional analysis, Municipal wastes, Potatoes, Sugar Beets, Inter-basin transfers, *Reviews, *Maine, Cost sharing, *Waste water treatment, Cost analysis, Industrial wastes, Treatment facilities, Sampling.

Identifiers: International stream (US-Canada), St. John River, Aroostook River, Prestile stream, Aroostook County, *Regional treatment, *Potato processing wastes, *Combined treatment.

Detailed sampling, gaging and laboratory analyses determined current waste loads from the Aroostook-Prestile Basin's potato processing industry. Studies indicated that significant reductions in load could be accomplished by in-plant conservation. Biological treatment of the residual wastes, however, was found necessary. Preliminary designs were prepared for numerous treatment and loading operations, including joint industry-municipal plants and regionally inter-connected systems. A transport-treatment channel system covering some eleven miles was shown to be technically feasible. Cost analyses of all viable options and alternatives were prepared, including capital and operating costs. Annual revenue requirements for each system were projected, including evaluation of current State and Federal grant-in-aid programs. Joint municipal-industrial treatment facilities proved the most economic course of action. The technical studies of the research and development program were evaluated for water quality impact on the receiving waters, as determined by Companion River Basin Studies. (EPA)

W73-11079

STATE-OF-THE-ART REVIEW OF PULP AND PAPER WASTE TREATMENT, Wapora, Inc., Washington, D.C.

H. Gehm.

Copy available from GPO Sup Doc as EPI.23/2-73-184, \$2.85; microfiche from NTIS as PB-221 434, \$0.95. NTIS PC55.35. Environmental Protection Agency, Technology Series Report EPA-R2-73-184, April 1973. 252 p. EPA Projects 12040 GLV and 12040 HAR. 68-01-0012.

Descriptors: *Pulp wastes, *Pulp and paper industry, Sulfite liquors, Waste treatment, Sludge treatment, *Reviews, *Waste water treatment, Sludge disposal, Oxidation, Suspended solids, Wood wastes, Industrial wastes.

Identifiers: *Waste characteristics, Treatment costs.

The state of the art in the treatment of pulp and paper mill wastewater as it stands in 1971 is presented. A review of both the general economic position of the industry as a whole and the major production processes is included. Such a background is needed since a considerable degree of loss control is practiced within the processes and water recycling is an almost universal practice in this industry. Included also is a review of the water quality problems which the applied treatment processes are designed to rectify. Performance data for treatment processes and systems are presented together with a review of the applicability of common analytical methods to the measurement of waste characteristics and treatment effectiveness. The techniques used to monitor waste flowages for control purposes and as means of recording treatment efficiency are in-

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Waste Treatment Processes—Group 5D

cluded. Finally, the remaining problems relative to control and treatment of pulp and paper mill spent process waters are pointed out. Research and development needs directed toward solving these problems are defined in the light of programs currently underway. (EPA)
W73-11080

OCCURRENCE OF SALMONELLA IN OXIDATION DITCHES,
Rijksinstituut voor de Volksgesondheid, Bilthoven (Netherlands). Lab. for Zoonoses.
For primary bibliographic entry see Field 05A.
W73-11136

REMOVAL OF MERCURY FROM AQUEOUS SOLUTIONS BY NITROGEN-CONTAINING CHEMICALLY MODIFIED COTTON,
Southern Regional Research Lab., New Orleans, La.
E. J. Roberts, and S. P. Rowland.
Environmental Science and Technology, Vol 7, No 6, p 552-555, June 1973. 3 fig, 1 tab, 12 ref.

Descriptors: *Mercury, *Aqueous solutions, *Cotton, *Waste water treatment, Laboratory tests, Analytical techniques, Testing procedures, Separation techniques, Filtration, Chemical reactions, Chemical analysis, Fibers, Polymers, Pollutants.

Four chemically modified cotton celluloses were investigated for effectiveness in sorbing (Hg^{++}) from aqueous solutions. Effectiveness of these compositions was due to amine units of the following types: ethylenimine network polymer formed in the fibers, polyethylenimine sorbed on the fibers, 2-diethylaminoethyl substituents in the cellulose. Cotton celluloses modified with 2-diethylaminoethyl or 2-aminoethyl substituents were the more effective compositions at concentrations of mercury above 1000 ppb. Cotton cellulose containing ethylenimine network polymer was most effective on the basis of the weight of the cellulosic composition. Sorbed mercury can be readily removed from the chemically modified cottons for recovery of the former and reuse of the latter. (Jerome-Vanderbilt)
W73-11174

MINERAL INDUSTRY VS. ECOLOGY.
For primary bibliographic entry see Field 05G.
W73-11185

PROCESS FOR THE REMOVAL OF CYANIDE FROM SEWAGE BY MEANS OF FORMALDEHYDE,
NIKEX, Budapest (Hungary), (assignee)
Z. Csuros, J. Petro, Z. Dusza, Z. Simo nee Barczy, and I. Turcsan.
U. S. Patent No. 3,729,413, 2 p, 3 ref; Official Gazette of the United States Patent Office, Vol 909, No 4, p 1354, April 24, 1973.

Descriptors: *Patents, Separation techniques, Poisons, *Pollutants, *Chemical reactions, *Waste water treatment, Pollution abatement, Water quality control, Water pollution control.
Identifiers: *Cyanide, *Chemical treatment, Glycolic acid.

The process for the removal of cyanide from sewage comprises converting the cyanide to glycolic acid by adding to the sewage at least one mol of formaldehyde solution per mol of cyanide and at a pH of at least 8 with intensive agitation. The solution is then allowed to stand at room temperature to 100°C for 1 to 50 hours. A metal salt is added to the solution to recover the glycolic acid as the metal glycolate. (Sinha-OEIS)
W73-11224

DE-OILING OF POLLUTED WATERS,
Agence Nationale de Valorisation de la Recherche, Courbevoie (France), (assignee)
A. Abadie, A. Gazost, and H. Roques.
U. S. Patent No. 3,729,410, 3 p, 5 ref; Official Gazette of the United States Patent Office, Vol 909, No 4, p 1354, April 24, 1973.

Descriptors: *Patents, Oily water, *Oil wastes, *Waste water treatment, Resins, *Ion exchange, Industrial wastes, *Pollution abatement, Water quality control, Water pollution control, Chemical reactions.
Identifiers: *Oleophilic resins, Organic ions, Chemical treatment.

Waste water is passed through a column containing oleophilic resin and the treated water is then removed from the resin. The oleophilic resin can be an ion exchange resin; the oleophilic properties are imparted to it by organic ions fixed on it. An ion-exchange operation can be conducted concurrently with the de-oiling process. (Sinha-OEIS)
W73-11226

WATER PURIFICATION WITH POROUS ABRASIVES,
Norton Co., Troy, N.Y. (assignee)
S. Eisner, and C. H. Rose.
U. S. Patent No. 3,728,253, 3 p, 4 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 909, No 3, p 1054, April 17, 1973.

Descriptors: *Patents, *Water purification, *Aeration, Oxygenation, *Microorganisms, *Waste water treatment, Water quality control, *Pollution abatement, Potable water, Water pollution control.
Identifiers: Hydrogen peroxide.

A porous abrasive belt, disc or drum aerates the water. The belt has a porous backing, preferably made of a foam material which is resilient and is able to alternately soak up water and air and then discharge either when squeezed in the presence of the opposite phase. The belt is rotated so there is always a portion in the water and a portion in the air. Being squeezed out the water cascades back into the body of water. In addition to aerating the water the abrasive of the belt can be used to generate nascent oxygen and hydrogen peroxide by being made to rub against and abrade quartz, aluminum, zinc, silica or other materials known to produce nascent oxygen or hydrogen peroxide. (Sinha-OEIS)
W73-11228

ACCELERATED BIOLOGICAL-CHEMICAL WASTEWATER TREATMENT,
California Univ., Berkeley. (assignee)
W. J. Kaufman.
U. S. Patent No. 3,728,253, 3 p, 1 fig, 1 ref; Official Gazette of the United States Patent Office, Vol 909, No 3, p 1054, April 17, 1973.

Descriptors: *Patents, *Phosphates, *Waste water treatment, *Biological treatment, Organic wastes, Pollution abatement, Water quality control, *Aeration, *Flocculation, Lime, Suspended solids, *Water pollution control, *Biochemical oxygen demand.
Identifiers: Clarification, Organic nitrogen, *Chemical treatment, Gravity settling, Alum.

This process uses as a first stage a biological system having an aerator and a sludge separator to remove soluble and colloidal organic materials, and as the second stage, a chemical system having a flocculator and a separator-clarifier adapted to remove phosphorus, along with suspended solids and some soluble organic compounds. Lime, alum or other floc-generating chemicals may be used. Solids formed in the second stage are recycled from the separator-clarifier to the first stage aerator in amounts sufficient to maintain the content of

inorganic suspended solids at between 30-60 percent by weight of total suspended solids. There is a resulting high degree of removal of organic nitrogen and phosphates. (Sinha-OEIS)
W73-11229

APPARATUS FOR TREATING SEWAGE,
Cole Resedev Corp., Fairlawn, N.J. (assignee)
W. R. Preis, and W. Cole.
U. S. Patent No. 3,728,245, 4 p, 4 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 909, No 3, p 1052, April 17, 1973.

Descriptors: *Patents, *Electrolysis, Bacteria, Oxidation, Chlorides, Oxides, Chemical reactions, *Flocculation, Color, Odor, *Ionization, *Waste water treatment.
Identifiers: *Chemical treatment, Sodium hydroxide.

A two-stage separator cell is provided. In the first, laminar flow of the liquid is effected and electrical energy introduced into the liquid. The treatment results in the separation of certain salt and water ions to produce free ions and, through a chemical reaction, sodium hydroxide. The sodium hydroxide causes a breakdown of fatty and oily substances into less complex settleable particles while the oxygen and chloride attack living organisms and colors and odors to cause a bleaching action and to oxidize bacteria. In the second stage of the cell, any existing residual ionization is cancelled out with a resultant rapid separation and flocculation of the solids existing in the solution with the aid of certain oxides and chlorides. (Sinha-OEIS)
W73-11231

SKIMMING DEVICE FOR USE ON A LIQUID SURFACE,
Gulf Oil Corp., Pittsburgh, Pa. (assignee)
J. L. Henning, Jr., and W. J. Robicheaux.
U. S. Patent No 3,727,765, 3 p, 3 fig, 12 ref; Official Gazette of the United States Patent Office, Vol 909, No 3, p 937, April 17, 1973.

Descriptors: *Patents, *Skimming, *Oil wastes, Oily water, *Waste water treatment, *Oil pollution, *Pollution abatement, Water quality control, Water pollution control, *Separation techniques, Equipment.

Skimming apparatus for removal of oil from the surface of settling ponds is discussed. A skimmer trough extends between and is supported by a pair of spaced floats. The skimmer trough is adjustable vertically on the floats to adjust the elevation of the upper edge of the trough relative to the floats, and thereby, the initial submergence of the overflow edge. A drain line from the lower end of the trough delivers liquid flowing into the trough to a sump from which the liquid is pumped from the system. An air bubbler line opens into the lower part of the skimmer trough and sends a signal responsive to the depth of oil in the trough to control the opening of the valve in the discharge line. (Sinha-OEIS)
W73-11233

WATER DECOMPOSITION APPARATUS,
World Water Resources, Inc., New York. (assignee).
For primary bibliographic entry see Field 05F.
W73-11234

PURIFICATION OF WASTE WATER,
Grace (W. R.) and Co., New York.
C. C. Legal, Jr.
U. S. Patent No 3,725,265, 6 p, 5 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 909, No 1, p 314, April 3, 1973.

Descriptors: *Patents, *Fluorides, *Phosphates, Sulfate, Calcium, *Waste water treatment, *Water

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

purification, Water treatment, Chemical reactions, Acidic water, Precipitation, Pollution abatement, Water quality control, Water pollution control.

Identifiers: *Chemical treatment.

The process for purifying an acidic waste water that contains fluoride, phosphate, calcium, and sulfate ions, and silica consists of the following steps. Ca(OH)₂ solution is added to the waste water. The resulting precipitate calcium fluoride is removed leaving a first filtrate. Then Ca(OH)₂ is added to the filtrate bringing the pH to 6.5 to 8.5. The second precipitate contains calcium phosphates as a major component. The second precipitate is removed and the purified water remains. The purified water contains only about 2-10 ppm fluoride ions and about 30-80 ppm phosphate ions. Eight examples are cited. (Sinha-OEIS) W73-11238

ACTIVATED SLUDGE SEWAGE TREATMENT PROCESS AND SYSTEM,

Air Products and Chemicals, Inc., Allentown, Pa. (assignee)
M. L. Spector, R. D. Jones, and C. S. McDowell.
U. S. Patent No. 3,725,258, 5 p, 4 fig, 1 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 909, No 1, p 312, April 3, 1973.

Descriptors: *Patents, *Sewage treatment, *Activated sludge, *Aeration, Dissolved oxygen, Pollution abatement, Water quality control, Water pollution control, *Waste water treatment.

The activated sludge sewage treatment process and system includes an initial closed aeration chamber into which mixed liquor, comprising aqueous waste and recycled sludge, is aerated in contact with an oxygen-rich aeration gas; the phrase 'oxygen-rich aeration gas' being defined as an aeration gas comprising at least 35% oxygen, by volume, and preferably 50 to 99.9% oxygen by volume. In at least the first portion of this enclosed aeration chamber, the dissolved oxygen content of the mixed liquor is maintained at a relatively high level such as between 3 and 15 ppm, and preferably between 5 and 10 ppm. After the aeration period in the closed chamber in contact with the oxygen-rich aeration gas, the mixed liquor is discharged into one or more open aeration chambers wherein further aeration is accomplished with atmospheric air at relatively lower dissolved oxygen levels until the purification process is completed to the desired degree. (Sinha-OEIS) W73-11239

ACTIVATED SLUDGE PROCESS AND SYSTEM,

Air Products and Chemicals, Inc., Allentown, Pa. (assignee),
R. E. McKinney.

U. S. Patent No 3,724,667, 6 p, 1 fig, 1 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 909, No 1, p 179, April 3, 1973.

Descriptors: *Patents, *Aeration, *Activated sludge, *Waste water treatment, Pollution abatement, Water quality control, Water pollution control.

Waste to be treated is first placed in the primary sedimentation tank and held there to permit settling of solids. The effluent is then passed to the aeration chamber where it is aerated and mixed with the liquor in the chamber. The waste to be treated is also mixed in the chamber with sludge which is recirculated from the secondary sedimentation tank. The sludge from the secondary tank provides the seed microorganisms to build up the activated sludge in the aeration chamber. The efficiency of oxygen transfer is greater with aerated droplets than with bubbles of gas which are diffused through the mixed liquor. The gas is injected under a pressure greater than atmospheric and the

gas in the upper region is maintained at a pressure greater than atmospheric. (Sinha-OEIS) W73-11240

TERTIARY FILTERING ARRANGEMENT,

S. Boorujy.
U. S. Patent No 3,722,681, 3 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 908, No 4, p 967, March 27, 1973.

Descriptors: *Patents, Pollution, *Tertiary treatment, *Filtration, *Waste water treatment, Water quality control, Water pollution control, Biochemical oxygen demand.

Identifiers: *Newsprint.

By this filtering arrangement, sewer effluent should be made suitable for discharge into rivers or streams. Suitably prepared waste newsprint may be utilized to remove suspended particulate matter from sewer water that has undergone secondary treatment. The processed newsprint is introduced into the sewage at the rate of 100 to 200 pounds to one million gallons of sewage that 95% of the BOD will be removed at a rate sufficient to meet the practical demands of a functioning disposal system. A filter element and a special scraper for cleaning the filter are provided. The scraper is apertured to permit the collected debris to enter within the scraper and the inside of the scraper is connected to a ventable line. The pressure developed by the cleaned liquid on the inside of the filter suffices when the ventable connection is made to force the cleaned water back through the filter flushing off debris from the outside of the filter. (Sinha-OEIS) W73-11241

APPARATUS FOR HANDLING SEWAGE,

R. I. Fletcher.
U. S. Patent No 3,720,320, 5 p, 2 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 908, No 2, p 362, March 13, 1973.

Descriptors: *Patents, *Sewage treatment, *Aerobic treatment, *Waste water treatment, Equipment, Pollution abatement, Water quality control, Water pollution control.

The apparatus is a horizontal, rotating, continuous-feed, multipass digester which is made up of a large horizontal cylinder which is designed to rotate about its horizontal axis. Oxygen, air or other gases are introduced under pressure. There are an odd number of concentric cylinders or tapered cylinders which run the length of the main cylinder. A flow through system makes this a compact arrangement which can be carefully regulated as to temperature, movement and gas content. (Sinha-OEIS) W73-11242

EMERGING WATER SUPPLY TECHNOLOGY.

New York State Temporary Commission on the Water Supply Needs of Southeastern New York, Albany.

For primary bibliographic entry see Field 03D.
W73-11246

COMPREHENSIVE WATER SEWER PLAN FOR BALDWIN COUNTY, ALABAMA.

Polyengineering, Mobile, Ala.
South Alabama Regional Planning Commission, Mobile, November, 1969. 218 p, 39 fig, 32 tab. HUD ALABAMA P (57) G.

Descriptors: *Planning, *Water supply, *Sewerage, *Storm sewers, Financing, Project planning, Utilities, *Alabama.

Identifiers: *Baldwin County (Ala), Inventories, Utility extension.

Twenty-seven towns and communities in Baldwin County are analyzed in terms of their water and sewer systems and future development programs. The report consists of an introductory section which establishes various county-wide objectives, criteria, and financing methods for water and sewer expansion programs and twenty-seven separate analyses of each urban area in the county. These analyses include a short history of the community, an inventory of the existing water and sewer systems, a discussion of the adequacy of these systems, a short range water supply development program, a long range (to 1990) water plan, a short range sanitary sewer development program, a long range sanitary sewer plan, and an evaluation of the storm sewer system. The key elements of these town-by-town analyses are the short range water and sanitary sewer development programs which include priorities for specific projects, the location of the projects on numerous maps, and the estimated costs. (Ellers-North Carolina) W73-11261

COMPREHENSIVE WATER AND SEWER PLAN FOR ESCAMBIA COUNTY, ALABAMA.

Polyengineering, Mobile, Ala.

South Alabama Regional Planning Commission, Mobile, November, 1969. 121 p, 20 fig, 20 tab. HUD Alabama P (57) G.

Descriptors: *Planning, *Water supply, *Sewerage, *Storm sewers, Financing, Project planning, Utilities, *Alabama.

Identifiers: *Escambia County (Ala), Inventories, Utility extension.

The basic approach of this detailed analysis and development program is one of looking at each town or community in the county separately. Thus, there are fifteen self-contained chapters each covering one town and each including a short history of the town, an inventory of the existing water and sewer systems, an analysis of the adequacy of these systems, a short range water supply development program, a long range water plan (to 1990), a short range sanitary sewer development program, a long range sanitary sewer plan, and a storm sewer analysis. The key features of these chapters are the short range water and sanitary sewer development programs which include priorities for specific projects, cost estimates, and detailed maps showing the projects. The town-by-town analyses are preceded by an introductory section which discusses overall county goals and objectives, standards and criteria, and financing methods. (Ellers-North Carolina) W73-11262

METAL TOXICITY TO SEWAGE ORGANISMS, A DISCUSSION.

Illinois Univ., Urbana. Dept. of Civil Engineering, M. Chaudhuri, and R. S. Engelhardt.
Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol 97, No SA6, p 944-945, December 1971. 3 ref.

Descriptors: *Activated sludge, *Fungi, *Heavy metals, *Toxicity, *Inhibition, *Growth rates, Sanitary engineering, Sewage treatment, Aerobic bacteria, Absorption, Copper, Silver, Nickel, Environmental effects, Enzymes, Waste water.

Identifiers: *Geotrichum candidum.

This article discusses a paper by Calvin P.C. Poon and Kiran L. Bhayani which was published in April 1971 (See W71-10313). Lack of information regarding the growth phase of cultures and presence of complexing agents severely limits the practical applicability of the data presented; and a more appropriate parameter of active biomass should be used. It is suggested that a careful monitoring of heavy metal concentrations and the factors favoring the growth of Geotrichum candidum over the normal population of activated sludge for

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Waste Treatment Processes—Group 5D

an extended period in an operating treatment plant would provide a better insight into this problem. (Jerome-Vanderbilt)
W73-11266

RECOVER ZINC FROM ZINC ASH.

Pacific Smelting Co., Torrance, Calif.

W. P. Reummler.
Chemical Engineering, Vol 97, No 13, p 70-71,
June 12, 1972. 1 fig.

Descriptors: *Separation techniques, *Zinc, *Chlorides, *Waste treatment, Chemical engineering, Metals, Absorption, Chemical reactions, Drying, Salts, Reduction (Chemical), Evaluation, Testing, Industrial wastes.

A unique zinc-recovery operation incorporates novel zinc chloride treatment steps that cut down on the problem of clogging of baghouse filters, because of zinc chloride moisture adsorption. The zinc ash treatment involves three basic operations, milling and metallic separation of zinc and zinc oxide, metallic zinc recovery, and crude zinc oxide treatment. In the oxide treatment step a neutralization reactor has been added to react soda ash with zinc chloride. The resulting zinc carbonate is converted to zinc oxide which yields metallic zinc upon milling. (Jerome - Vanderbilt)
W73-11281

CURTAILING POLLUTION FROM METAL FINISHING.

Industrial Filter and Pump Mfg. Co., Cicero, Ill.
J. F. Zievers, and C. J. Novotny.
Environmental Science and Technology, Vol 7,
No 3, p 209-213, March 1973. 1 tab, 3 fig, 6 ref.

Descriptors: *Waste water treatment, *Industrial wastes, *Design criteria, Waste disposal, Heavy metals, Phenols, Phosphates, Hydrogen ion concentrations, Toxins, Oil, Separation techniques, Reverse osmosis, Filtration, Chemical reactions, Evaporation, Ion exchange, Sedimentation, Aeration, Cost analysis, Estimated costs.
Identifiers: *Metal finishing wastes.

Wastes produced during metal finishing operations, the various procedures used in the treatment of these wastes and the cost of these different methods are discussed. The seven major pollutants produced during metal finishing operations are: cyanides, hexavalent chromium, pH fluctuations, oil, heavy metals, phenols, and phosphates. Six procedures can be followed to result in the smallest treatment plant possible handling the least possible quantity of wastes. These are: housekeeping to avoid unnecessary spills, mixes and process losses; segregation of different waste components for easier treatment; proper scheduling for the most efficient treatment; reduction of effluent volume by countercurrent rinses; reduction of the intensity of the wastes by changing plating baths used; and changes in the chemistry of the process. Twelve commonly used waste treatment processes discussed are: dilution, containment, chemical conversion, combustion, evaporation or reverse osmosis, ion exchange, deep-well disposal, sedimentation, clarification, aeration, filtration and combination. A discussion of treatment cost includes capital cost, operating cost and the possibility of material recovery. (Jerome - Vanderbilt)
W73-11283

CHLORINE MAKERS CLUTCH AT LAST DROPS OF MERCURY.

Chemical Week, Vol 108, No 8, p 75-77, February 24, 1971.

Descriptors: *Waste water treatment, *Mercury, Pollution abatement, Water pollution, *Industrial wastes, Industrial production, Chemical wastes, Chlorine.
Identifiers: *Chlor-alkali industry.

According to the Chlorine Institute the chlorine industry has reduced by more than 95% the mercury in its liquid waste effluent since the problems of mercury discharge have become clear. Thus far some 20 million dollars have been spent for treatment. In general mercury leaves the mercury cells of a chlorine plant primarily in the hydrogen, caustic and chlorine streams. These streams are recycled where possible. The remainder are treated. Some measures presently taken by domestic industries are described. These include the sulfide treatment and iron flocculation which yield effluents with mercury in the range of 100-300 ppb. Other methods include Monsanto's Brink melt eliminators used to remove mercury from vent gas streams, Bayer's catalytic approach, N. J. Zinc's zinc dust mercury precipitate, Osaka Soda reuse method, and methods based on redesign of cells. (Oleszkiewicz - Vanderbilt)
W73-11288

WATER SUPPLY IMPROVEMENTS FEATURE NEW COAGULATOR.

Crew (Alfred), Ridgewood, N.J.
For primary bibliographic entry see Field 05F.
W73-11315

PHOSPHORUS REMOVAL, A BIBLIOGRAPHY, VOLUME 1.

Office of Water Resources Research, Washington, D.C.

Available from the National Technical Information Service as PB-221 477, \$3.00 in paper copy, \$0.95 in microfiche. Water Resources Scientific Information Center Report WRSIC 73-208, May 1973, 275 p.

Descriptors: *Bibliographies, *Eutrophication, *Nitrogen, *Nutrient removal, *Phosphates, *Waste water treatment, Activated sludge, Biological treatment, Industrial wastes, Phosphorus compounds, Sewage treatment, Sludge treatment, Tertiary treatment, Water reuse, Filtration, Farm wastes, Oxidation lagoons.
Identifiers: *Phosphorus removal.

This report, containing 175 abstracts, is another in a series of planned bibliographies in water resources to be produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the data base had 53,230 abstracts covering SWRA through February 15, 1973 (Volume 6, Number 4). This volume includes abstracts of documents published through 1969. Author and subject indexes are included. (See also W73-11320) (OWRR)
W73-11319

PHOSPHORUS REMOVAL, A BIBLIOGRAPHY, VOLUME 2.

Office of Water Resources Research, Washington, D.C.

Available from the National Technical Information Service as PB-221 478, \$6.00 in paper copy, \$0.95 in microfiche. Water Resources Scientific Information Center Report WRSIC 73-208, May 1973, 465 p.

Descriptors: *Bibliographies, *Eutrophication, *Nitrogen, *Nutrient removal, *Phosphates, *Waste water treatment, Activated sludge, Biological treatment, Industrial wastes, Phosphorus compounds, Sewage treatment, Tertiary treatment, Water reuse, Filtration, Farm wastes, Oxidation lagoons.
Identifiers: *Phosphorus removal.

This report, containing 317 abstracts, is another in a series of planned bibliographies in water resources to be produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the

time of search for this bibliography, the data base had 53,230 abstracts covering SWRA through February 15, 1973 (Volume 6, Number 4). This volume includes abstracts of documents published in 1970-1972. Author and subject indexes are included. (See also W73-11319) (OWRR)
W73-11320

BIOLOGICAL REMOVAL OF CARBON AND NITROGEN COMPOUNDS FROM COKE PLANT WASTES.

American Iron and Steel Inst., New York.

J. E. Baker, and R. J. Thompson.

Copy available from GPO Sup Doc as EP1.23/2:73-167, \$2.35; microfiche from NTIS as PB-221 485, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-167, April 1973, 178 p, 9 fig, 23 tab, 65 ref. EPA Project 12010 EDY.

Descriptors: Aerobic conditions, Anaerobic condition, Biochemical oxygen demand, Heated water, Industrial wastes, Nitrogen compounds, Organic matter, Phenols, Biological treatment, *Waste water treatment, *Carbon, Activated sludge, Pilot plants.

Identifiers: *Coke plant wastes, Ammonia liquor, Nitrification, Denitrification.

A one-year study of a biological process for treatment of coke plant ammonia liquor was conducted. The process was designed to remove carbon compounds and ammonia. The pilot plant consisted of three treatment systems arranged in series. These systems were designed for the removal of carbon compounds, the oxidation of ammonia to nitrate (nitrification), and the reduction of nitrate to nitrogen gas (denitrification). The study was jointly sponsored by the American Iron and Steel Institute, the Environmental Protection Agency, and Armco Steel Corporation. The results of the study indicate that the biological process can be used to remove carbon compounds and ammonia from dilute ammonia liquor. Treatment efficiencies obtained include removals of greater than 99.9 percent phenol, 80 percent COD, and 90 percent ammonia. Removal efficiencies for cyanide and thiocyanate were less encouraging with averages of 57 and 17 percent, respectively. (EPA) W73-11328

DYESTUFF COLOR REMOVAL BY IONIZING RADIATION AND CHEMICAL OXIDATION.

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

T. F. Craft, and G. G. Eichholz.

Copy available from GPO Sup Doc as EP1.23/2:73-048, \$2.10; microfiche from NTIS as PB-221 486, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-048, March 1973, 118 p, 66 fig, 2 tab, 32 ref. EPA Project 12000 FZB.

Descriptors: Dyes, *Gamma rays, *Oxidation, *Waste water treatment, Industrial wastes, Color.
Identifiers: *Dye industry wastes, *Textile finishing wastes, Gamma radiation, Chemical oxidation, *Color removal.

The effects of a combined radiation-oxidation process on solutions of textile dyes have been studied. The combined treatment with gamma radiation and chlorine causes more decolorization than the effect of the two components when they are applied individually. Several chemical classes of dyes were tested, including anthraquinone, azo, metallized azo, sulfur, stilbene, and triphenylmethane dyes. At a concentration of 0.25 g/l the transmittance at the wave-length of maximum absorbance of dye solutions is greatly increased by treatment with a radiation dose of 60 kR plus 75 ppm chlorine. Non-optimized cost estimates indicate \$0.31/1000 gal. for design treatment, with normal operating costs potentially lower. Although the major benefit from this treatment will be

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

removal of color, some reduction of chemical oxygen demand will occur, and possibly some reduction in the biochemical oxygen demand. (EPA) W73-11329

LOW WATER VOLUME ENZYME DEACTIVATION OF VEGETABLES BEFORE PRESERVATION,

National Canners Association Research Foundation, Calif.

J. W. Ralls, and W. A. Mercer.

Copy available from GPO Sup Doc as EPI.23/2:73-198; \$1.25; microfiche from NTIS as PB-221 511, \$0.95. Environmental Protection Agency, Technology Series EPA-R2-73-198, May 1973, 88 p, 5 fig, 25 tab, 18 ref. EPA Project 12060 PAV.

Descriptors: *Food processing industry, *Waste water treatment, Microwave, Steam, *Pilot plants, Costs.

Identifiers: *Canning (Food processing), *Blanching, Microwave blanching, Steam blanching, *Vegetable wastes, Food processing wastes.

Four pilot-plant units were operated with asparagus, peas, corn, beans, beets, pumpkin and spinach to establish the potential for new blanching systems with low wastewater generation. The systems investigated were microwave, hot-gas, steam, and hot-water. Single runs of about one hour duration were made for each commodity with each blanching system. Wastewater volume was measured and samples were analyzed for COD, SS, and pH. The most striking result obtained was the small volume of steam condensate formed during hot-gas blanching. Canned samples of vegetable material from each blancher were prepared for quality evaluation after storage. Tast panels showed no significant flavor preference for samples from any individual blanching system. The system used had no significant effect on the vitamin and mineral retention of blanched or canned samples. The oxygen content of canned samples was lowest for hot-gas blanching compared to the other three systems. Estimates of the cost of blanching using commercial-scale units gave (dollars/ton blanched): microwave, 18.47; hot-gas, 3.39; steam, 2.21; and hot-water, 2.36. (EPA)

W73-11330

ECONOMIC FEASIBILITY OF MINIMUM INDUSTRIAL WASTE LOAD DISCHARGE REQUIREMENTS,

Datagraphics, Inc., Pittsburgh, Pa.

Henry C. Bramer.

Copy available from GPO Sup Doc as EPI.23/3:73-016, \$2.10; microfiche from NTIS as PB-221 490, \$0.95. Environmental Protection Agency, Socioeconomic Studies Series Report, EPA-R5-73-016, April 1973, 118 p, 19 fig, 66 tab, 24 ref. EPA Contract 2800775, Project 68-01-0196.

Descriptors: *Economics, *Industrial wastes, Costs, *Waste water treatment, Treatment facilities, Waste disposal, *Cost analysis.

Identifiers: *Treatment costs, *Zero discharge requirement.

Order-of-magnitude estimates of the costs of implementing minimum and zero discharge requirements for the manufacturing and electric power industries are presented. The analysis was made, for the most part, at the 2 digit S.I.C. level for the manufacturing industries. The assumed technology was maximum in-plant recirculation and reuse, concentration of the recirculation blowdown by evaporation, and final residual disposal by the applicable least-cost method among incineration, deepwell disposal, solar evaporation, and ocean disposal. It is concluded that a strict zero discharge requirement would have greatly variable and significant economic consequences, but that

less stringent definitions of minimum discharge would be feasible. The limiting factors in applying a strict zero discharge requirement appear to be the availability of physical resources, particularly energy, for purposes of effluent concentration. (EPA)

W73-11335

ULTRA HIGH RATE FILTRATION OF ACTIVATED SLUDGE PLANT EFFLUENT,

Hydrotechnic Corp., and C-Y. Fan.

Copy available from GPO Sup Doc as EPI.23/2:73-222, \$2.10; microfiche from NTIS as PB-221 492, \$0.95. Environmental Protection Agency, Technology Series Report, EPA-R2-73-222, April 1973, 114 p, 15 fig, 20 tab, 13 ref. EPA Project 17030 HMM.

Descriptors: *Separation techniques, *Tertiary treatment, *Filtration, *Activated sludge, Coagulation, *Waste water treatment, *Ohio, Polymers. Identifiers: *Cleveland (Ohio), Alum, Polymer, Dual-media, Ultra-high rate, Variable studies.

Pilot plant studies were conducted at the Southerly Wastewater Treatment Plant in Cleveland to evaluate the capabilities of the deep bed, dual media, ultra high rate filtration process for treating an activated sludge plant secondary effluent. The various operating variables that were treated and evaluated, included different media sizes, sizes, varying depth, bed, filtration rates from 8 to 32 gpm/sq ft, different types of polymer, and different combinations of coagulants and polymers. The principal parameter for evaluating process efficiency was suspended solids. High removals were obtained with respect to suspended solids and to pollutants associated with suspended solids. The removal of these pollutants reduced biochemical oxygen demand, chemical oxygen demand and total phosphate values. Capital costs for a filtration process of this type as estimated to range from \$1,200,000 for a 25 MGD plant to \$5,400,000 for a 200 MGD plant. Total treatment costs, including capital and operating charges, are estimated to be 4.32-2.97 cents/1000 gallons for the 25 and 200 MGD plants respectively. (EPA)

W73-11337

SECONDARY WASTE TREATMENT FOR A SMALL DIVERSIFIED TANNERY,

Caldwell Lace Leather Co., Auburn, Ky.

E. L. Thackston.

Copy available from GPO Sup Doc as EPI.23/2:73-209, \$1.25; microfiche from NTIS as PB-221 494, \$0.95. Environmental Protection Agency, Technology Series Report, EPA-R2-73-209, April 1973, 75 p, 13 fig, 24 tab, 30 ref. EPA Project 12120 EFM. WPRD 25-01.

Descriptors: *Waste water treatment, *Activated sludge, *Industrial wastes, Testing, Evaluation, Laboratory tests, Sampling, Settling basins, Chemical oxygen demand, Biochemical oxygen demand, *Kentucky.

Identifiers: *Tannery wastes, Leather production.

The Caldwell Lace Leather Co. of Auburn, Kentucky, a small tannery using primarily alum tanning, received a demonstration grant in 1967 from the WPCPA to investigate and demonstrate methods of treating tannery wastes for discharge to a small stream. A research contract with Vanderbilt University produced findings which have previously been reported and are reviewed herein. A modified completely-mixed activated sludge plant was constructed, along with facilities to handle specific problem wastes. After it had been operating for a year an EPA survey team conducted a study which showed that the plant was performing as predicted by the research phase, except for solids carryover from the secondary clarifier due to mechanical problems. After the problems were

corrected, the plant began producing an effluent which more than met expectations, removing 97% of the suspended solids and 95% of the BOD. Due to conservation measures inside the tannery, however, the load on the plant is somewhat less than the design load, so the plant is operating as an extended aeration plant. (EPA)

W73-11340

ACTIVATED CARBON FOR WATER TREATMENT,

West Virginia Pulp and Paper Co., Tyrone, Pa.

Chemical Div.

For primary bibliographic entry see Field 05F.

W73-11352

SLUDGE CONCENTRATION,

Polymer Corp. Ltd., Sarnia (Ontario). (assignee)

R. C. MacKenzie.

U.S. Patent No 3,729,412, 3 p, 2 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 909, No 4, p 1354, April 24, 1973.

Descriptors: *Patents, Liquid wastes, *Polymers, *Sludge treatment, *Secondary treatment, *Waste water treatment, Pollution abatement, Water quality control, Water pollution control.

Identifiers: Latex.

A process is provided for the concentration of solids of a sludge derived from waste water. It comprises mixing (a) an aqueous sludge containing at least 0.5 weight percent of suspended solids, the solids being substantially polymeric material, with (b) a latex containing more than about 0.5 weight percent of rubbery polymeric solids and (c) a coagulating agent selected from the mineral acids, calcium chloride and aluminum chloride. An isolatable coagulum is formed containing the suspended polymeric material and the rubbery polymeric solids. The coagulum is separated from the aqueous phase; the separated coagulum contains at least 25 weight percent solids. (Sinha-OEIS)

W73-11357

APPARATUS FOR SEPARATING POLLUTANTS AND OBTAINING SEPARATE LIQUIDS AND SOLIDS,

Pollutant Separation, Inc., Elmwood, Conn. (assignee)

H. J. Burnett.

U.S. Patent No 3,729,042, 3 p, 1 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 909, No 4, p 1265, April 24, 1973.

Descriptors: *Patents, Equipment, Separation techniques, Slurries, *Sewage treatment, *Municipal wastes, *Waste water treatment, Water pollution control, Water quality control, Solids, Pollution abatement.

The apparatus consists of a sewage receiving tank, a collecting tank, and a grinding pump. The sewage is ground into a slurry and transferred to the collection tank. There is a condensate receiving tank and a vapor condensing tank, as well as a closed high pressure surge tank, an electric transformer, and a series of connected pipe coils including one in each of the condensate receiving and condensing tanks. A high pressure pump forces slurry from the collecting tank through the pipe coils into the surge tank where it is subjected to high temperatures. The heated slurry is moved to the low pressure in the vaporizing chamber where vaporization of the liquids in the slurry takes place. The condensate from the vapors of the slurry are discharged so as to preheat the incoming slurry passing through the pipe coils leading to the area where they are heated to high temperatures. (Sinha-OEIS)

W73-11359

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Waste Treatment Processes—Group 5D

GENERIC FEED FORWARD CONTROL OF ACTIVATED SLUDGE,
Kentucky Univ., Lexington. Dept. of Chemical Engineering.

J. J. Davis, R. I. Kermode, and R. W. J. Brett.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 99, No EE3, Proceedings paper 9803, p 301-314, June, 1973. 5 fig, 4 tab, 9 ref.

Descriptors: *Activated sludge, *Simulation analysis, *Digital computers, *Optimization, *Sewage treatment, *Environmental engineering, Water quality, Streams, Equations, Mathematical models, Systems analysis.

Identifiers: *Feed forward control.

Feed forward controllers for the completely mixed activated sludge process have been developed and tested by computer simulation against the sludge growth rate models of five authors. Control is effective for all models and it is shown to apply generally to growth models wherein specific growth rate is any function of substrate concentration. The control strategy involves manipulation of the recycle rate of return sludge. When the recycle rate is under proportional control from measurement of influent flow rate and differential control from measurement of influent substrate concentration, soluble substrate in the effluent is minimized and stabilized. With recycle sludge storage, control is more effective. (Bell-Cornell) W73-11362

MULTILEVEL CONTROL OF MULTIPOLLUTANT SYSTEM,
Case Western Reserve Univ., Cleveland, Ohio. Systems Research Center.

For primary bibliographic entry see Field 05G.

W73-11363

PRESERVATION OF LAKE BAYKAL (OB OKHRANE OZERA BAYKAL),
Hydrometeorological Service of the USSR, Moscow.

For primary bibliographic entry see Field 05C.

W73-11407

ECOLOGICAL AND PHYSIOLOGICAL IMPLICATIONS OF GREENBELT IRRIGATION - PHASE I,
California Univ., Riverside. Dept. of Plant Sciences.

J. R. Goodin, and W. D. Kesner.

Available from the National Technical Information Service as PB-221 534, \$3.00 in paper copy, \$0.95 in microfiche. California Water Resources Center Technical Completion Report, 1972, 37 p, 8 fig, 7 tab. OWRR B-090-CAL (1), 14-31-0001-3058.

Descriptors: Sewage effluents, Groundwater, *California, *Water waste disposal, *Water reuse, Irrigation systems, Vegetation.

Identifiers: *Maloney Canyon (Calif), Lake Arrowhead (Calif), San Bernardino National Forest, *Greenbelts, Firebreaks.

A cooperative project between US Forest Service, University of California, Lake Arrowhead Sanitation District and San Bernardino County Flood Control District studied greenbelts irrigated with sewage effluent as a new and perhaps less costly means of reducing wildfire hazards, while disposing of waste water and recharging groundwater reservoirs in the mountain regions. Phase I covers site selection in Maloney Canyon, San Bernardino National Forest, as a controlled field location. Natural flora and fauna inventoried; contour mapping completed; surveying; construction of access roads and jeep trails; planning of irrigation system and construction of study plots are reported. (See also W73-06525 and W73-06526)

W73-11424

A DYNAMIC PROGRAMMING APPROACH FOR INVESTMENT STRATEGIES IN WASTE-WATER TREATMENT PLANTS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.

J. M. Armstrong.

Available from the National Technical Information Service as PB-221 646, \$4.85 in paper copy, \$0.95 in microfiche. Project Completion Report, East Lansing, Michigan State University, Institute of Water Research, March 1973. 71 p, 25 fig, 7 ref. 3 append. OWRR-A-036-Mich (1), 14-31-0001-3022.

Descriptors: *Waste water treatment, *Investment, Management, *Treatment facilities, Planning, Model studies, Decision making.

The transport of waste materials has long been considered an acceptable use of water. The general rule has been to capture the water, put it to use, and then discard it with only a minimal level of treatment. The level of treatment has been based on what is needed to prevent, or keep to an acceptable minimum, nuisance and damages to downstream users of the receiving body. This practice has been the result of the attitude that water has very little value in and of itself. The inherent characteristics of water investments make it necessary to formulate plans and decisions based on a future of twenty years or longer, but there is no 'one future' on which to base the decision. An attempt is made to develop a management tool which will aid the decision maker in evaluating the many alternatives available to him. A mechanism is needed which will provide the decision maker with the best investment strategy for any given set of assumptions about the future and must be able to accomplish the task quickly and at a minimal cost. The model generates the optimal capacity schedule within its limited discrete universe. Solutions agree with the analytical expectations for simple demand curves of linear or geometric shape. The model provides a cheap and convenient means of exploring alternate futures in actual decision making situations. At the least, it provides some method of calculating the cost of forecasting errors. The model has the potential, with some refinement, to become a component in a regional decision model.

W73-11426

NATIONAL MEAT-PACKING WASTE MANAGEMENT RESEARCH AND DEVELOPMENT PROGRAM,

Robert S. Kerr Environmental Research Lab., Ada, Okla.

J. L. Witherow, S. C. Yin, and D. M. Farmer.

Copy available from GPO Sup Doc as EPI.23/2-73-178, \$0.75; microfiche from NTIS as PB-221 546, \$0.95. Environmental Protection Technology Series Report EPA-R2-73-178, March 1973. 33 p, 10 fig, 3 tab, 13 ref. EPA Project 12060 FGF.

Descriptors: *Industrial wastes, *Waste water treatment, Water pollution sources, *Water pollution control, Canneries, Research priorities, *Water reuse, *Management.

Identifiers: *Meat-packing wastes, *Research programs, Food processing wastes.

The meat-packing process is viewed from the standpoint of its use and discharge of water. The concept of integrated water management through in-plant control, solids recovery and disposal, wastewater treatment, and water reuse is presented. The necessity for in-plant change in unit processes and housekeeping practices to reduce waste loads is shown by the wide variation in discharges from similar plants. The scope of the meat industries' waste management problem is defined, and the objectives of the National Meat-Packing Waste Management Research Program are categorized. Environmental Research Need Statements are introduced as a means by which the meat industry can present its waste treatment

problems to the program. The past and current research projects are briefly described according to objectives and accomplishments with more detailed information referenced. The results of the recent waste survey of the meat industry are given along with interpretation of their meaning. Future research projects will evolve around closed-loop technology. Unit processes which offer great potential in waste reduction are described as the initiation point for a program to reach the goal of 'no discharge of pollutants.' (EPA) W73-11440

A FLOW PROPORTIONAL COMPOSITE SAMPLER,
Wisconsin State Univ., Platteville.

For primary bibliographic entry see Field 05A.
W73-11463

WASTEWATER MANAGEMENT THROUGH LAND UTILIZATION - MUSKEGAN COUNTY, MICHIGAN, USA,
Environmental Protection Agency, Washington, D.C.

J. A. Krivak.

Paper, Int Symp Plann Water Resour, Mexico City, Mexico, Dec 1972. 28 p, 2 fig, 1 tab, 26 ref.

Descriptors: *Water reuse, *Sprinkler irrigation, *Environmental effects, Social impact, Evaluation, Wastewater disposal, Research and development, Waste water (Pollution), Bibliographies, Sewage, Economic impact, Agriculture, Reclaimed water, Industrial wastes, Water quality. Identifiers: *Environmental quality, Environmental evaluation, Land-use practices, Groundwater quality, Irrigation reuse, Effluent reuse.

Waste water reclamation provides an opportunity for increasing water supplies in many areas. Interest has been renewed in planning and development of land utilization systems as a means of eliminating pollution and providing beneficial water use. The project described, in Muskegon County, Michigan, will initially use reclaimed water to spray-irrigate 6,000 acres of agricultural land. This disposal system, to be operational in the summer of 1973, will be fully tested and evaluated in an urban area. The project encompasses a 501-sq-mi area and will provide waste treatment for a community of 156,000 people and 5 major industries. A continuing research program for systems monitoring and evaluation will be conducted for at least 5 yrs after the system becomes operational. Studies will include monitoring the quality of both surface and ground waters; evaluating performance of treatment components, agricultural productivity, and the social, economic, and environmental impact of the project. A brief history and different methods of applying waste waters to the land for treatment are given. (USR) W73-11515

CONSTRUCTION OF A PURIFICATION PLANT FOR POLLUTED WATER USING PHOTOSYNTHETIC BACTERIA,
Kyoto Univ. (Japan). Dept. of Agricultural Research.

M. Kobayashi, M. Kobayashi, and H. Nakanishi. J Ferment Technol Vol 49, No 9, p 817-825, 1971. Illus.

Identifiers: Bacteria, Biochemical oxygen demand, Chlorella cells, *Photosynthetic bacteria, *Waste water treatment, *Sewage purification, Pilot plants.

This pilot plant was able to purify sewage with over 10,000 ppm Biochemical Oxygen Demand, without any dilution, for 1 wk. In this purification process, photosynthetic bacteria and Chlorella cells are harvested as by-products. This plant does not leave a sediment as is the case with an activated sludge method.—Copyright 1972, Biological Abstracts, Inc.
W73-11569

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

PETROLEUM HYDROCARBONS AND FATTY ACIDS IN WASTEWATER EFFLUENTS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05B.
W73-11575

MERCURY IN PUBLIC SEWER SYSTEMS,
Illinois State Water Survey, Peoria. Water Quality Section.
R. L. Evans, W. T. Sullivan, and L. Sundar.
Water and Sewage Works, Vol 120, No 2, p 74-76,
February 1973. 2 fig, 1 tab, 13 ref.

Descriptors: *Mercury, *Pollutant identification, *Sewerage, *Municipal wastes, Waste water (Pollution), Water quality standards, Heavy metals, Chemical analysis, Domestic wastes, Sewage effluents, Illinois, Pollutants, Water sampling, Methodology.
Identifiers: *Flameless atomic absorption spectrophotometry, Sample preservation.

A summary is presented of analyses for total mercury in a limited number of samples from raw sewage of five municipalities in central Illinois (Creve Coeur, Morton, Marquette Heights, Washington, and Peoria). At least 10 grab samples were collected in polyethylene bags from each sewer system near the intake structure of the waste treatment facilities. The samples were preserved with dilute nitric acid and analyzed for Hg using the flameless atomic absorption method of Hatch and Ott (1968). Values of total Hg concentrations found in the raw sewage ranged from 0.1 to 7.9 ppb. The geometric mean of total mercury concentrations in the five public sewer systems in central Illinois ranged from 1.3 to 1.8 ppb. Illinois standards stipulate a maximum concentration of 0.5 ppb of mercury in public sewer systems. Without lowering the existing tolerance guidelines for mercury in foodstuffs, paper products, drinking water, etc., it would appear difficult to comply with Illinois standards. There appears to be a background concentration of mercury in public sewer systems solely devoid of industrial waste influence. (Holoman-Battelle)
W73-11585

PHOSPHORUS IN WASTE WATER,
New York State Dept. of Environmental Conservation, Albany. Research and Development Unit.
L. J. Hetling, and I. G. Carich.
Water and Sewage Works, Vol 120, No 2, p 59-62,
February 1973. 3 fig, 6 tab, 45 ref.

Descriptors: *Phosphorus, *Detergents, *Waste water (Pollution), *Soaps, Chemical analysis, Water pollution sources, Domestic wastes, New York, Water sampling, Water analysis, Flow rates, Separated sewers, Nutrients, Pollutants.
Identifiers: *Pressure sewer system, Dissolved phosphorus, Pollutant removal.

A demonstration of the use of pressure sewers to determine the proportion of phosphorus contributive to domestic waste from detergents was conducted in Albany, New York, using 12 individual, single family homes connected to a pressure main via grinder-pump units. All waste water but extraneous flows (cellar, yard, and roof drainage) produced was included in the system during installation. Using a specially constructed device, a composite sample was collected daily along with complementary waste water flow data and analyzed for total and dissolved phosphorus daily for 3 weeks. A non-phosphate, heavy duty soap was then substituted in each household for the usual phosphorus detergent. Daily composite samples were collected and analyzed for a 3-week period. A 48 percent reduction of the total phosphorus was found when phosphorus free soap was used in place of phosphorus detergents. As expected, all of this decrease occurred in the soluble form. The particulate phosphorus loading remained essentially constant throughout the experiment. Removal of phosphorus from detergent

washing products would lower concentrations of phosphorus in waste water from the present average of 11 mg/l to approximately 5 mg/l. (Holoman-Battelle)
W73-11592

COMPREHENSIVE REGIONAL WATER AND SEWER INVENTORY AND ANALYSIS,
Alabama-Tombigbee Rivers Regional Planning and Development Commission, Camden.
For primary bibliographic entry see Field 07B.
W73-11670

MSB COMPUTERIZED COMBINED SEWER CONTROL SYSTEM,
Metropolitan Sewer Board St. Paul, Minn.
For primary bibliographic entry see Field 05G.
W73-11673

OZONATION OF MICROSTRAINED SECONDARY EFFLUENT,
Metropolitan Sanitary District of Greater Chicago, Ill.

D. R. Zenz, and M. J. Weingarten.
Paper presented at a symposium on Ozonation in Sewage Treatment, Wisconsin University, Department of Engineering, University Extension, Madison, November 9-10, 1971. 59 p, 20 fig, 14 tab, 15 ref.

Descriptors: *Ozone, *Sewage treatment, *Tertiary treatment, Engineering estimates, Feasibility studies, Municipal wastes, Industrial wastes, Water pollution control, Waste water treatment, Illinois.
Identifiers: Chicago.

The use of ozone in water treatment has been confined to drinking water treatment until recently. Ozonation of waste water had not been seriously studied previously because of the interference of the organic material in the waste water with the ozone. With tertiary treatment, however, much of the organic material is removed and the use of ozone may be practical. Consideration of ozone in water treatment is based on the possibility of superior treatment with ozone as compared to chlorine. It is known, for example, that ozone can reduce colors and odors that chlorine cannot reduce and, in addition, ozone can reduce substances such as oils, cyanides, phenols and other substances upon which chlorine has no effect. Certain viruses are also killed by ozone, while not killed by chlorine, and ozonation leaves no residual, breaking down to elemental oxygen. The Metropolitan Sanitary District of Greater Chicago initially tested ozonation to determine other effects and costs of ozone. Using a pilot plant and treating microstrained secondary effluent, the following conclusions were reached: (1) ozone is a very effective bactericide, with ozone dosages of 6.0 mg/l virtually eliminating fecal coliform, total coliform and fecal streptococcus; (2) ozone produces striking color reductions; (3) ozone dosages above 6 mg/l produced modest reductions in turbidity; (4) ozone produces a definite reduction in BOD; (5) costs for ozonation at the pilot plant were high, but considerably lower costs are predicted for full scale plants; and (6) ozone demand for satisfactory treatment appears high, and a contact time of 6 minutes was needed. (Poertner)
W73-11678

LEACHATE QUALITY FROM ACIDIC MINE SPOIL FERTILIZED WITH LIQUID DIGESTED SEWAGE SLUDGE,
Metropolitan Sanitary District of Greater Chicago, Ill.

For primary bibliographic entry see Field 05G.
W73-11680

5E. Ultimate Disposal of Wastes

GEOLOGY AND GROUND-WATER CHARACTERISTICS OF THE HANFORD RESERVATION OF THE U.S. ATOMIC ENERGY COMMISSION, WASHINGTON,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W73-11204

GROUND RUPTURE IN THE BALDWIN HILLS,
Earth Sciences Associates, Palo Alto, Calif.
D. H. Hamilton, and R. L. Meehan.
Science, Vol 172, No 3981, p 333-344, April 1971. 12 fig, 1 tab, 14 ref.

Descriptors: *Faults (Geologic), *Injection wells, *Waste disposal, *Dam failure, *California, Oil industry, Earth dams, Rupturing, Cracks, Collapses, Reservoirs.
Identifiers: *Baldwin Hills Reservoir (Calif), Los Angeles (Calif).

December 14, 1963, water burst through the foundation and earth dam of the Baldwin Hills Reservoir, a hilltop water storage facility located in metropolitan Los Angeles. The contents of the reservoir, some 250 million gallons of treated water that had filled the artificial, 20-acre clay-and-asphalt-lined basin to a depth of 70 feet, emptied within hours onto the communities below the Baldwin Hills, inundating a square mile of residences with mud and debris, and damaged or destroyed 277 homes. Since 1963 geologists and engineers have been intensively investigating this crack and several similar ones nearby all known to be surface expressions of deep, near-vertical faults of Pliocene or greater age. That the earth-crack ground rupturing of the Baldwin Hills was genetically related to high-pressure injection of fluid into the previously faulted and subsidence-stressed subsurface seems established beyond reasonable doubt. Experience in the Baldwin Hills suggests that, although fluid injection operations may be carried out for beneficial purposes, the effects of such injection on the geologic fabric can be serious and far-reaching. (Woodard-USGS)
W73-11206

BROWN COUNTY SEWAGE AND SOLID WASTE STUDY - 1972,
Brown County Regional Planning Commission, Green Bay, Wis.

Available from the National Technical Information Service as PB-213 636, \$17.75 in paper copy, \$0.95 in microfiche. Brown County Regional Planning Commission, Green Bay, Wisconsin. 1972 Final Report. 313 p, 6 figs, 6 plates, 5 append. W. S. P-139 G.

Descriptors: *Planning, *Sewerage, *Solid wastes, Interceptor sewers, Timing, Administration, Projections, Landfills, *Wisconsin.
Identifiers: Brown County (Wis.), Reuse factors.

A detailed and straightforward planning approach for waste disposal in Brown County, Wisconsin, is presented. Emphasis is on the location and time phasing of interceptor sewers and the provision and operation of sanitary landfills. Each chapter describes one particular step or element of the planning process. These include physical descriptions of the drainage basins and soils, population projections, state legislation and standards, planning goals, sewage treatment technology, solid waste collection methods, waste generation factors, service areas, alternative plans, and proposed facilities. County-wide interceptor sewers are proposed and a County Sewerage Commission is recommended to administer the system. Recycling solid wastes is explored but the empha-

sis
meet
Was
Nor
W73

LEA
MO
Nor
Phys
H. S.
Natu
1973
Des
*Pla
tests
stud
Ident
raph

This
tion
elect
Mos
know
conc
Lead
micro
inclus
lecte
within
dam
clusio
repre
parti
which
(Oles
W73-

WAS
LAN
MIC
Envir
D.C.
For p
W73-

LAND
NON
OF O
Feder
Cincin
G. K.
Kenn
Avail
PB-21
micro
Resea
Press.

Descri
*Land
Water
Ident
Three
techni
ing. Th
soil m
quantit
range
land s
footpri
althoug
conditi
is to i
increas
decreas
and n
bioche
acceler

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Treatment and Quality Alteration—Group 5F

sis is on operating landfills and incinerators to meet federal and state standards. A County Solid Waste Authority is also recommended. (Elfers - North Carolina)
W73-11250

LEAD ACCUMULATION WITHIN NUCLEI OF MOSS LEAF CELLS,
Norges Tekniske Høgskole, Trondheim. Dept. of Physics.
H. Skar, E. Ophus, and B. M. Gullvag.
Nature, Vol 241, No 5386, p 215-216, January 19, 1973. 2 fig, 13 ref.

Descriptors: *Lead, *Mosses, *Heavy metals, *Plants, *Toxicity, Air pollution, Laboratory tests, Analytical techniques, Metals, Cytological studies.

Identifiers: Accumulation, Electron microphotography, Biological samples.

This study of accumulation of lead within vegetation growing near busy roads was based on the electron scattering properties of heavy metals. Mosses were chosen for the study as they are known to accumulate heavy metals beyond the concentrations that are toxic for other plants. Lead was detected by means of electron microphotographs which revealed electron dense inclusions in the cells from the lead-treated samples. Both laboratory studies and tests on field collected samples revealed electron dense particles within the nuclei, with the nuclear membrane damaged. It is believed that the electron-dense inclusions found within the nuclei of moss cells represent lead complexes - an assumption based partly on the chemical analysis of moss leaves which revealed about 50 ppm of lead (dry weight). (Oleszkiewicz - Vanderbilt)

W73-11276

WASTEWATER MANAGEMENT THROUGH LAND UTILIZATION - MUSKEGAN COUNTY, MICHIGAN, USA,
Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 05D.

W73-11515

LAND SPREADING, A CONSERVING AND NON-POLLUTING METHOD OF DISPOSING OF OILY WASTES,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Ohio Basin Region.

G. K. Dotson, R. B. Dean, W. B. Cooke, and B. A. Kenner.

Available from NTIS, Springfield, Va 22151 as PB-213 749 Price \$3.00 printed copy; \$0.95 microfiche. Preprint, Advances in Water Pollution Research, Vol 1, S. W. Jenkins, editor: Pergamon Press, p II-36-1-II-36-12, 1971. 4 fig, 4 tab, 20 ref.

Descriptors: *Waste disposal, *Oil industry, *Land, Methodology, Soil properties, Absorption, Water pollution control, Biodegradation.

Identifiers: *Land spreading (Oil waste).

Three land spreading operations describe different techniques of disposing oil sludge by land spreading. The results of the investigations show that: (1) soil microbes can oxidize and decompose a large quantity of petroleum hydrocarbons under a wide range of soil and environmental conditions; (2) land spreading is economical and comparatively foolproof method of disposing of oily wastes; (3) although large additions of oil may create toxic conditions for plants, the eventual effect upon soil is to improve physical and chemical properties by increasing organic matter and nitrogen content, decreasing volume weight and increasing porosity and moisture holding capacity; (4) natural biochemical decomposition of oil in soil may be accelerated by judicious use of lime and fertilizer, artificial drainage, and tillage; and (5) microbiolog-

ical degradation of oily wastes takes place under a wide range of temperature, but oxidation is faster in warm or hot climates than it is in cold. (Woodard-USGS)
W73-11535

DISPOSAL OF URANIUM-MILL EFFLUENT BY WELL INJECTION IN THE GRANTS AREA, VALENCIA COUNTY, NEW MEXICO,
Geological Survey, Washington, D.C.

S. W. West.

For sale by GPO, Washington, D.C., 20402 Price \$1.55. Geological Survey Professional Paper 386-D, 1972. 28 p, 6 fig, 4 plate, 8 tab, 5 ref.

Descriptors: *Waste water disposal, *Radioactive wastes, *Sulfates, *Industrial wastes, *Injection wells, Aquifer characteristics, Water analysis, Chemical analysis, Water quality, Pumping, Testing procedures, Water level fluctuations, Hydrogeology, Permeability, Well data, Cores, Path of pollutants.

Identifiers: *Uranium-mill effluent.

In Valencia County, New Mexico, the geologic and hydrologic environment in the vicinity of the Bluewater uranium mill of the Anaconda Company seems favorable for disposal of mill effluent into a deep well. Beds of sandstone in the Yeso Formation of Permian age, at depths of 950 to 1,423 feet, accept 200 to 400 gallons per minute of water under gravity flow. Water in the injection interval contained 3,900 parts per million of dissolved solids, of which 2,200 was sulfate. A thick interval of siltstone, anhydrite, and gypsum of low permeability in the upper part of the Yeso Formation separates the injection interval from the principal freshwater aquifer in the Glorieta Sandstone and the San Andres Limestone of Permian age. The disposal well was tested thoroughly during and following drilling, core samples were analyzed for porosity and permeability, and a set of geophysical logs was made to supplement other data. The well was completed by installing plastic-lined casing, cementing the annulus outside the casing, and gun perforating selected intervals of the casing. (Woodard-USGS)
W73-11551

CHEMICAL AND BIOLOGICAL QUALITY OF MUNICIPAL SLUDGE,
Metropolitan Sanitary District of Greater Chicago, Ill.

J. R. Peterson, C. Lue-Hing, and D. R. Zeng. Paper delivered at the Symposium on Recycling Treated Municipal Wastewater and Sludge Through Forest and Cropland, Pennsylvania State University, University Park, August 22, 1972. 16 p, 3 tab, 23 ref.

Descriptors: *Sewage sludge, *Chemical analysis, *Sewage disposal, Biological properties, Illinois, Domestic wastes, Industrial wastes, Water pollution control, Nutrients, Soil disposal fields.

Identifiers: *Chicago (Ill).

The use of sewage sludge for fertilizer or other land application demands an understanding of the sludge's chemical and physical properties. Such characteristics depend on the type and degree of waste treatment; for example, primary digested sludge has a lower nitrogen and phosphorus content than secondary digested sludge. The addition of industrial wastes to domestic wastes increases practically all chemical components except calcium. Methods of treatment by the Metropolitan Sanitary District of Greater Chicago have produced variations in pH from 6.2 for digester feed to 7.5 for lagooned wastes. Total solids varied from 3.99 percent for lagooned wastes to 99.5 percent for vacuum filtered and heat-dried wastes. Analyses of sludges from six sewage treatment plants across the nation show similar variations, some quite small; but, other analyses have shown variations of up to 45 percent. The use of sludge

for land applications will depend on the chemical, biological and physical properties. Although some sludges might be acceptable chemically, others would be toxic to plant and animal life. Generally, sludges do have an excellent supply of plant nutrients available for use by the soil. They are also a good source of humus. (Poerter)
W73-11679

5F. Water Treatment and Quality Alteration

REACTOR MODEL PARAMETERS - TWO-PHASE REACTOR DESIGN TUBULAR REACTORS,
Delaware Univ., Newark. Dept. of Chemical Engineering.

P. T. Cichy, and T. W. F. Russell.

Industrial and Engineering Chemistry, Vol 61, No 8, p 15-26, August 1969. OWRR A-008-DEL (2).

Descriptors: Oxygenation, *Mathematical models, *Mass transfer, Chemical reaction, *Pipelines, Design.

Identifiers: Reactor design.

Methods of evaluating the model parameters in the design equations for the process of mass transfer and reaction in tubular systems are presented and discussed from a design viewpoint.
W73-11138

APOLLO EXPERIENCE REPORT, POTABLE WATER SYSTEM,
National Aeronautics and Space Administration, Houston, Tex. Manned Spacecraft Center.

R. L. Sauer, and D. J. Calley.

Available from NTIS Springfield, Va 22151, NASA TN D-7291 Price \$3.00 printed copy; \$0.95 microfiche. National Aeronautics and Space Administration Technical Note TN D-7291, June 1973. 12 p, 2 fig.

Descriptors: *Satellites (Artificial), *Water supply, *Potable water, *Electric power, *Water storage, Methodology, Water quality, Waste water treatment, Microbiology, Bacteria, Water cooling, Sublimation, Humidity, Condensation.

Identifiers: *Manned spacecraft, Apollo spacecraft, Command module, Service module.

The design and function of the Apollo potable water system are described. The command module potable water is supplied as a byproduct of the fuel cells. The cells, located in the service module function primarily to supply electrical energy to the spacecraft. The source of the lunar module potable water is three storage tanks, which are filled before lift-off. The technique of supplying the water in each of these cases and the problems associated with compatibility of materials are described. The chemical and microbiological quality of the water is reviewed, as are efforts to maintain the water in a microbiologically safe condition for drinking and food mixing. (Woodard-USGS)
W73-11202

METHOD AND APPARATUS FOR DETECTING THE HARDNESS LEVEL OF WATER,
Eric Mfg. Co., Milwaukee, Wis. (assignee)

For primary bibliographic entry see Field 07B.

W73-11227

WATER DECOMPOSITION APPARATUS,
World Water Resources, Inc., New York. (assignee).

C. A. Soriano, and W. E. Hanford.

U. S. Patent No 3,727,760, 6 p, 5 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 909, No 3, p 935, April 17, 1973.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F—Water Treatment and Quality Alteration

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality, Equipment, Potable water, Chlorination.
Identifiers: *Chemical treatment.

A flow control device is responsive to the level of the potable water supply. There is a variable hydrostatic pressure chamber having a valve which opens when the pressure in the chamber is less than the hydrostatic pressure of the water source. A pressure relief device communicates with the variable hydrostatic pressure chamber so that when the level of the potable water supply reaches a predetermined minimum, the relief device operates to reduce the hydrostatic pressure in the chamber. A conduit extends from the chamber to the water source and water is introduced into the chamber until the hydrostatic pressure of the chamber is about equal to the hydrostatic pressure of the water source. Another conduit is positioned below the water level of the lower chamber and perpendicular to the flow of water through the lower chamber, thereby creating a swirling movement in the water to assure a constant chemical dissolution rate. An example using chlorine is cited. (Sinha-OEIS)
W73-11234

SOFTENING OF SEA WATER BY ADDITION OF BARIUM CARBONATE AND CO₂,
Department of the Interior, Washington, D.C. (Assignee).

P. G. Gelblum.
U.S. Patent No. 3,725,267, 3 p., 3 fig., 5 ref.; Official Gazette of the United States Patent Office, Vol 909, No. 1, p 315, April 3, 1973.

Descriptors: *Patents, *Water softening, *Water treatment, *Scale prevention, *Distillation, Chemical reactions, *Carbon dioxide.
Identifiers: *Barium carbonate.

This invention is concerned with softening sea water prior to evaporation or distillation procedures. Barium carbonate and catalytic amounts of CO₂ are added to the sea water. The barium bicarbonate which forms then reacts with sulfate and calcium. The resulting precipitate consists of barium sulfate and calcium carbonate. The softened water may then be heated to precipitate out magnesium hydroxide. (Sinha-OEIS)
W73-11236

SOFTENING OF SEA WATER BY ADDITION OF BARIUM CARBONATE AND MINERAL ACID,
Department of the Interior, Washington, D.C. (Assignee).

P. G. Gelblum.
U.S. Patent No. 3,725,268, 2 p., 2 fig., 5 ref.; Official Gazette of the United States Patent Office, Vol 909, No. 1, p 315, April 3, 1973.

Descriptors: *Patents, *Water softening, *Scale prevention, *Desalination, *Scaling, *Water treatment, Chemical reactions.
Identifiers: Barium carbonate.

This invention provides for softening of sea water prior to evaporation or distillation to prevent scaling in the equipment. Barium carbonate and small, catalytic amounts of a mineral acid or its oxide are added to the sea water. Barium bicarbonate forms and reacts with sulfate and calcium. The precipitate which forms consists of barium sulfate and calcium carbonate. Little or no magnesium is removed from the water in this process. (Sinha-OEIS)
W73-11237

ENVIRONMENTAL HEALTH PLANNING.
Bureau of Community Environmental Management, Rockville, Md.
For primary bibliographic entry see Field 05G.
W73-11244

WATER-SOLIDS SEPARATION IN AN UPFLOW: WITH PARTICULAR REFERENCE TO USE OF A SLURRY POOL FOR SOLIDS CONTACT IN WATER TREATMENT

A. W. Bond.

Journal of the Institution of Water Engineers, Vol 20, No. 7, p 477-489, October 1966. 8 fig., 4 ref.

Descriptors: *Water treatment, Sanitary engineering, *Filtration, Sedimentation, Coagulation, *Velocity gradient.

Identifiers: Sludge blanket, Microfloc, Solids contact, *Slurry concentration.

Properties and characteristics are described of a slurry pool in a uniformly expanding upflow solids contact basin, part of a water treatment plant, in elaboration of work carried out in a model. The plant is located at Bacchus Marsh, Victoria, Australia. Discussed are the effect of slurry production (which causes the slurry to rise) on the upflow velocity-concentration relation, the use of slurry recirculation in increasing the upflow velocity, the effects of temperature, the relation between upflow velocity and time of solids contact, the effects of variations and shock changes in the rate of upflow, the variation of slurry concentration in a uniformly expanding upflow zone, and the manner in which slurry is transferred over a slurry weir into a concentrator. (Bean-AWWARF)
W73-11313

H₂S REMOVAL FROM WATER WITHOUT AIR POLLUTION,

Eglin Water Dept., Ill.

N. H. Nelson, and C. A. Jepson.

Public Works, Vol 94, No. 1, p 97-98, January 1963. 1 tab.

Descriptors: *Water treatment, *Water quality, *Aeration, Oxygen, Chlorination, *Design, Odor, *Illinois.

Identifiers: Ferrous sulfate, *Hydrogen sulfide removal, Permanganate, Sulfur dioxide, Elgin (Ill.).

Caught between the problems of a raw water supply with a high hydrogen sulfide content and complaints due to air pollution when the water was aerated, Elgin, Illinois, turned to precipitation of the sulfides with ferrous sulfate. The water system is served by eight wells 1,250 to 1,945 ft deep. The static and pumping levels dropped rapidly in 1958-9 and the hydrogen sulfide content increased from trace to 4 mg/l. Chlorine dosage was increased to burn up the hydrogen sulfide which greatly increased the cost. (Also, the hydrogen sulfide was destroying the concrete ceiling of the raw water chamber.) Oxidizing agents considered were oxygen, chlorine, sulfur dioxide and potassium permanganate. Oxygen would have to be applied in pure form to avoid a sweeping out effect causing air pollution. Chlorine required was 5 ppm per ppm of hydrogen sulfide. Sulfur dioxide reaction in solution at ordinary temperatures is slow. Potassium permanganate is expensive. A feeder was purchased and ferrous sulfate treatment was adopted. The dosage of 3.5 mg/l by trial and error was reduced to 2.4 mg/l. Today ferrous sulfate is not only removing 100 percent of the hydrogen sulfide from the water supply but its use has cut the amount of alum used by 50 percent and the amount of chlorine used by 25 percent. (Bean-AWWARF)
W73-11314

WATER SUPPLY IMPROVEMENTS FEATURE NEW COAGULATOR,

Crew (Alfred), Ridgewood, N.J.

A. Crew.

Public Works, Vol 93, No 12, p 68-71, December 1962. 1 fig.

Descriptors: *Water treatment, Sedimentation, *Filtration, Phosphates, Design, *New Jersey, *Coagulation, Settling basins.

Identifiers: *Permutet unit, Haledon (N.J.).

At Haledon, N.J., the water supply reservoir averages only 8 ft. in depth with storage estimated at 185 mg when full, and safe yield at 0.88 mgd. It serves 2,500 consumers, an average of 1.13 mgd. (This includes some water purchased from the Passaic Valley Water Commission.) Treatment units consisted of two sedimentation basins each with a capacity of 900,000 gallons, five rapid sand filters using Anthrafilt media with carbonaceous underdrains, a 170,000 gal. clear well, and chemical feeders for carbon, alum, soda ash, Calgon and chlorine. Included in new facilities designed in 1960 was a new coagulation-sedimentation unit 43 ft in diameter, and 12 ft deep. The reinforced concrete tank houses a Permutet unit furnished by the Permutet Co., designed for a maximum rate of 1400 gpm, minimum detention time 90 minutes. This is the first municipal installation of the unit in the U.S. though it has operated on process water in a paper mill in New England. Several municipal installations have been made in the Union of South Africa. The raw water and coagulating chemicals are mixed in the influent line of the Permutet unit and enter at the center of the tank floor beneath the conical rotor float. Clarified effluent is collected by a peripheral weir. (Bean-AWWARF)
W73-11315

OZONATION AT WHITING: 26 YEARS LATER,

Whiting Water Works, Ind.

J. F. Bartuska.

Public Works, Vol 98, No. 8, p 112-114, August 1967. 1 ref.

Descriptors: *Water treatment, *Water quality, Sanitary engineering, *Ozone, Activated carbon, Chlorination, Taste, Odor, *Indiana, *Water pollution treatment.

Identifiers: Whiting (Ind.).

Whiting's source of water supply, lower Lake Michigan, became so polluted that the city found it necessary to build a purification plant in 1920. Pollution increased in the thirties so that the activated carbon required was not economically feasible, and did not produce an acceptable improvement in taste and odor. Because phenols were present in the water, chlorine produced a chlorophenol taste. The City installed an ozonation plant of 50 lbs/day capacity, later increased to 75 lbs/day, which is still in operation (26 years later). Nearly 40 percent reduction in other chemicals resulted and water with higher initial threshold odors is being reduced to levels lower than possible before the ozonation treatment was adopted. (Bean-AWWARF)
W73-11316

A WATER SYSTEM DESIGNED TO ATTRACT INDUSTRY,

Oregon Water Dept., Ohio.

E. D. L. York, and S. J. Wittenberg.

Public Works, Vol 95, No 5, p 118-119, May 1964.

Descriptors: *Water treatment, *Sanitary engineering, *Water supply, Industrial plants, *Public benefits, Storage, Economics, Design, *Ohio.

Identifiers: Distribution systems, Oregon (Ohio).

Oregon, Ohio, decided that its future was dependent upon its ability to attract new industries and to help those already established there by offering a sufficient water supply. Water was then purchased from the City of Toledo. Residents voted a one percent payroll tax and earmarked the funds for a water plant. Funds also were provided under the Federal Public Works Acceleration Act of Sept. 14, 1962. An 8 mgd plant was built, with a 48-in intake line from Lake Erie, and a 1 mgd elevated storage tank. The system was extended to provide service to a larger area. Excess water was offered to two neighboring communities. Four major oil companies are now operating refineries in Oregon, two new major industries are virtually

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Treatment and Quality Alteration—Group 5F

assured of locating in the area and four new housing subdivisions are under construction. (Bean-AWWARF) W73-11317

TASTE AND ODOR CONTROL IN WATER,
Mississippi State Univ., State College. Dept. of
Sanitary Engineering.
E. J. Middlebrooks.
Public Works, Vol 96, No 4, p 127-130, April 1965.
1 fig, 2 tab, 8 ref.

Descriptors: *Water treatment, *Water quality, *Sanitary engineering, Chlorination, Ozone, Chlorine dioxide, Activated carbon, *Taste, *Odor.

Causes of tastes and odors are discussed. Algae, decaying vegetation, and industrial wastes are the usual causes. Measurement of odors by the threshold odor test, together with carbon adsorption and extractions by chloroform and alcohol are described. Preventive treatments by use of copper sulfate and chlorine are discussed and a table shows concentrations required for different algae. The roles of ozone, chlorine dioxide and activated carbon can play in destruction or removal of odors are also discussed. (Bean-AWWARF) W73-11318

ACTIVATED CARBON FOR WATER TREATMENT.
West Virginia Pulp and Paper Co., Tyrone, Pa.
Chemical Div.
A. Y. Hyndshaw.
Taste and Odor Control Journal, Vol 32, No 1, p 1-7, January 1966. 6 fig, 2 tab.

Descriptors: *Water treatment, *Activated carbon, *Chlorine, Water quality, *Coagulation, *Organic compounds, Taste, Odor.

The action of chlorine is one of oxidation or 'burning up' of unwanted substances in water. Because carbon can adsorb chlorine, the two substances should rarely be applied in close proximity - rather, depending upon the circumstances, one or the other should be applied and time allotted to obtain maximum benefits before adding the other. Figures illustrate contrasting results with different waters. In some, chlorine should be applied first, while in others the carbon should be first. This indicates that some materials are more readily adsorbed by chlorine before they are chlorinated, others are more readily adsorbed after they are chlorinated. Chlorine demand may sometimes be reduced by preceding carbon application. Activated carbon application in the coagulation process will remove many organic compounds, thereby reducing tastes and odors. (Bean-AWWARF) W73-11412

EVALUATION OF NEW ALGICIDES FOR WATER SUPPLY PURPOSES,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
C. M. Palmer.
Taste and Odor Control Journal, Vol 23, No 1, p 1-4, January 1957. 10 ref.

Descriptors: *Water treatment, *Algae, *Algicides, *Antibiotics, Zinc, Copper sulfate, Chlorine.
Identifiers: Activated silver, Chlorine dioxide, Quinones, Quaternary ammonium compounds, Rosin amines.

For control of algae in water intended for domestic and industrial uses, only two basic chemicals—copper sulfate and chlorine—are commonly recommended, in great contrast to the rapidly increasing number of chemicals being made available for control of pests in commodities other than water.

Research indicates promising possibilities with compounds containing quaternary ammonium compounds, rosin amines, quinones, activated silver, urea compounds, chlorophenates, antibiotics, organic zinc, copper and chlorine compounds such as copper citrate and cupric-chloramine, and chlorine-dioxide. The new compounds will be more expensive than those presently in use and will therefore be used under careful control. They will probably be selective as to the type of algae affected. There are, as yet, no completely new algicides which appear to be safe for use in public water supplies. (Bean-AWWARF) W73-11353

REVERSE OSMOSIS WATER PURIFYING SYSTEM WITH GRADIENT BARRIER WATER STORAGE CONTAINER,
Desalination Systems, Inc., Escondido, Calif. (as-signee)
For primary bibliographic entry see Field 03A.
W73-11356

HELICOPTER APPLICATION OF COPPER SULFATE,
East Bay Water Co., Oakland, Calif.
D. G. Rosenburg.
Taste and Odor Control Journal, Vol 30, No 8, p 1-6, Aug. 1964. 1 tab.

Descriptors: *Water treatment, *Algae, *Copper sulfate, Microorganisms, Taste, Odor, Economics.
Identifiers: *Helicopter application.

Treatment of the San Pablo Reservoir, for control of algae, generally required three or more applications of copper sulfate each year, when applied by boat. Helicopter treatment proved more effective, requiring only two treatments. This saves \$1,200. in material cost which pays for the two helicopter flights required. Applications equal 10 to 14 lbs/acre. The criteria for grind of copper sulfate were, (1) it must be compatible with the feeding equipment, (2) dissolve in the top 10 ft of the water, (3) create a minimum drift problem, and, (4) be commercially available at an economical price. (Bean-AWWARF) W73-11419

HOW TO BLACK OUT ALGAE,
Wilmington Board of Water Commissioners, Del.
M. S. Shane.
Taste and Odor Control Journal, Vol 29, No 9, p 1-4, Sept. 1963. 1 tab.

Descriptors: *Water treatment, *Algae, *Crustaceans, *Activated carbon, Microorganisms, Fish, Taste, Odor, Copper sulfate, Chlorine.
Identifiers: Alum, Backwashing, Blackout, Filter runs.

Growth of algae in an open 35 mg pre-settling reservoir caused taste and odor and very short filter runs. Copper sulfate treatment was practiced twice a week in spring and summer but growths of moss and microorganisms (algae and crustaceans) occurred. Fish population was reduced to near extinction. Filter runs were only 7 to 10 hours. A dosage of 2 to 3 ppm activated carbon reduced algae growths, corrected the taste and odor problems, allowed increased fish propagation, and lengthened the filter runs to around 35 hours. The 2 ppm application appeared by observation to allow a penetration of sunlight of only 1.5 to 2 feet. The reduction in algae count due to the 'blackout' resulted in lower dosages of alum, chlorine and copper sulfate. Washwater use was reduced. As a result of the improvement in operations and quality it was decided to continue the carbon treatment throughout the entire year. (Bean-AWWARF) W73-11420

TASTE AND ODOR CONTROL - CHEMICALS AND METHODS.
West Virginia Pulp and Paper Co., Tyrone, Pa.
Technical Service Lab. Staff.

Descriptors: *Water treatment, *Algae, *Taste, *Odor, Ammonia, Copper sulfate, Activated carbon, Chlorine, Ozone, Oxidation, *Aeration
Identifiers: Aeration, Chlorine dioxide, Permanaganate, Chemical treatment.

Methods for controlling tastes and odors include (a) prevention of taste formation by application of ammonia, copper sulfate, and activated carbon, (b) oxidation of taste and odor compounds by chlorine, ozone, chlorine dioxide, and potassium permanganate, and (c) adsorption of taste and odor bodies on activated carbon. Ammonia applied before chlorine will prevent formation of malodorous chlorine compounds. Copper sulfate reduced growth of algae which cause odors. Activated carbon will cause 'blackout' excluding light thereby reducing algae growths. Aeration removes volatile compounds such as hydrogen sulfide and increases the dissolved oxygen content. Chlorination in the free chlorine range will destroy many substances which otherwise may cause taste and odor. Ozone, one of the strongest oxidants available is used extensively in Europe for disinfection. Chlorine dioxide, generated in the water plant by reaction of sodium chloride with chlorine has much greater oxidizing power than chlorine. It is effective for destruction of phenol-type odors. Potassium permanganate can oxidize some troublesome organics to less odorous compounds. The method most widely used in adsorption on activated carbon and measurement of tastes and odors, particularly the threshold odor test. (Bean-AWWARF) W73-11421

ACTIVATED CARBON FOR PALATABLE WATER: GRANULAR OR POWDERED.
Westvaco Corp., Covington, Va. Chemical Div.

Taste and Odor Control Journal, Vol 35, No 3, p 1-10, March 1969. 6 fig.

Descriptors: *Water treatment, *Organic compounds, *Activated carbon, *Chlorine, Tastes, Odor, Potable water.
Identifiers: *Granular carbon filters.

Compared to other water treatment practices, granular carbon filtration is relatively new. While current technology has provided an economical and effective method for treating water, there still remain a number of unknown quantities that must be studied. These include reaction depths of beds, biological growths in granular carbon beds, quality of granular carbon after repeated regeneration, adverse effect of high turbidity upon sorptivity, and breakthrough of odors, all of which are discussed. The data now indicate that with the possible exception of plants which superchlorinate, powdered carbon will normally be more economical than granular carbon for plants feeding low dosages of powdered carbon. For plants feeding high dosages, it appears that granular carbon will be more economical. The powdered carbon dosage at which granular becomes more economical depends upon a number of factors, which are discussed. Pilot studies at dosages below 2 ppm are impractical. (Bean-AWWARF) W73-11422

TWO-POINT COPPER SULFATING PROGRAM LICKS/ALGAE PROBLEM,
Richmond Dept. of Public Utilities, Va.
W. W. Anders.
Water Works Engineering, Vol 114, No 8, p 700-701, 729, 732, August 1961. 2 tab.

Descriptors: *Water treatment, Sanitary engineering, *Algal control, Algicides, *Copper sulfate, Taste, Odor, *Water distribution (Applied), Distribution systems.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F—Water Treatment and Quality Alteration

Identifiers: Richmond (Virginia).

By practicing chemical control in the raw water in its James River settling basins, and augmenting this procedure with application to the filtered water ahead of aeration, Richmond, Virginia has licked its taste and odor problems, carried algae throughout its distribution system, and kept its mains and meters clean. The algae vary, and dosages vary, with the seasons throughout the year. Each week the settling basins are treated with copper sulfate; 600 lbs. in summer and 200 lbs. in winter. Treatment of filtered water is continuous to maintain a residual of copper entering the distribution system equal to 0.15 to 0.20 ppm in the warmer months, and 0.10 to 0.15 ppm in winter. This is sufficient to retard algal propagation in the open reservoir, elevated storage tank and distribution system mains. There is no evidence of copper build-up in the distribution system. The reduction of bad water complaints and the freedom from stopped and clogged meters provide a handsome return on the small cost of this copper treatment. (Bean-AWWARF) W73-11447

FILTER WASHING GOES MODERN,

Fischer and Porter Co., Warminster, Pa.

M. W. Herman.
Water Works Engineering, Vol 113, No 10, p 894-899, October 1960. 6 fig.

Descriptors: *Water treatment, Sanitary engineering, Filtration, *Design, *Automation, Cleaning, Treatment facilities.

Identifiers: *Backwashing.

Washing filters is a task that consumes a great many hours annually. Automatic washing can take the drudgery out of the time-consuming operation. Systems are available with warning features which apprise the operator of any malfunction. They are available to operate and return the filter to service upon completion of the wash, the entire process is started by a push button. Other systems will bring the washing cycle to a halt in the event of a component failure, and resume operation only when the failure has been corrected. Filter plants, like most process plants, are individuals, each with its own requirements, limitations and peculiarities. What works well for one may not be required or even desirable for another. Hence, a filter washing system must be designed around a given plant, or around a set of plans from which the plant is to be built. Plant size, water characteristics, piping layouts, operator coverage and other factors must be considered. (Bean-AWWARF) W73-11448

ZETA POTENTIAL CONTROL IMPROVES COAGULATION OF COLLOIDAL WATER.

Water Works Engineering, Vol 113, No 8, p 712-716, August 1960. 9 fig.

Descriptors: *Water treatment, Sanitary engineering, *Zeta potential, *Colloids, Settling velocity, *Filtration, *Electrolytes, Chlorination, New York, Treatment facilities.

Identifiers: Activated silica, Waterford (New York).

The Waterford, New York, treatment plant handles polluted raw water from the Hudson River and delivers high quality water at a rated capacity of 2 mgd. It is the first plant specifically designed and operated on the basis of continuous control of zeta potential. Wastes of pulp and paper mills, and textile industries, prevented the old plant from delivering water of satisfactory taste and odor and at more than half its rated capacity. The new plant has better chemical feed facilities, more effective treatment and control devices and zeta potential control of coagulants and polyelectrolyte coagulant aids. The object of controlling the zeta potential and improving the molecular structure is to

produce an alum or ferric floc which will adsorb, enmesh and remove more organic colloids than is possible with standard practice; these colloids were responsible for tastes and odors in the finished waters. The major cause of suspension of colloids is the electrical charge on the surface of particles. Zeta potential measurements indicate these charges. When they have neutralized, destabilization occurs, aiding flocculation. Treatment includes chlorination, activated carbon, aeration, alum with zeta potential control, activated silica, cationic polyelectrolyte and anionic polyelectrolyte, settling, filtration and secondary chlorination. (Bean-AWWARF)

W73-11449

MICROSTRAINING REMOVES ALGAE AND CUTS FILTER BACK-WASHING.

Water Works Engineering, Vol 113, No 4, p 554-555, April 1960.

J. Scriven.

Descriptors: *Water treatment, *Filtration, *Algae, Costs, Plankton, Cleaning, Treatment facilities, Canada.

Identifiers: *Microstraining, Backwashing, Belleville (Canada).

Following successful pilot plant tests, four microstraining units were installed at Belleville to overcome short filter runs caused by heavy loads of plankton during the summer months. High backwash requirements were coupled with heavy and uneconomical consumption of coagulants, causing increased operating costs while rising demands on the supply became more difficult to meet. The new units reduced backwashes to less than one-quarter in number, and the volume of water used for backwash of filters and for strainers to a little over one-half the amount previously used for backwashing. (Bean-AWWARF) W73-11450

DESIGN FACTORS FOR EFFECTIVE SETTLING OF COAGULATED WATER,

Massachusetts Inst. of Tech., Cambridge.
R. Eliassen, and E. A. Cassell.

Water Works Engineering, Vol 110, No 11, p 1105-

1107, November 1957. 4 fig.

Descriptors: *Water treatment, *Design, *Settling velocity, Coagulation, *Filtration, Sludge, Weirs, Overflow, Cleaning, Treatment facilities.

Identifiers: *Backwashing.

Efficient operation of rapid sand filters, to provide long runs and low backwash water consumption, depends upon the removal of greater than 95 percent of the floc particles in the settling tank. To accomplish this, the design engineer must consider all design factors which influence good operation of settling tanks. Vertical settling velocity of floc is most important—good coagulation should produce floc with settling velocity exceeding 2 ft. per hour. Dense calcium carbonate floc may settle at 10 ft. per hour. Horizontal flow through the tank must be low enough to avoid scouring of settled sludge. The settling velocity of the floc and the horizontal water flow must allow the floc to reach the tank bottom before reaching the effluent end and it must remain there as sludge, until removed. Weir design is especially important with light alum floc; the vertical velocities must be kept as low as possible. Good practice limits the weir overflow rate to 30,000 gpd per ft of weir length. Weir plates are frequently a series of small V-notches about 2 in deep and spaced from 6 to 12 inches on center, to assure more uniform flow over the weirs. (Bean-AWWARF) W73-11661

PROGRESS REPORT ON WATER QUALITY OF LAKE MICHIGAN NEAR CHICAGO.

Chicago Dept. of Water and Sewers, Ill.

For primary bibliographic entry see Field 05B.

W73-11581

SOFTENING A 46-GRAIN WATER,

Elmira Water Works, Ohio.

N. Damschroder, and R. Murphy.

Water Works Engineering, Vol 115, No 10, p 818-819 and 853, October 1962. 2 fig, 1 tab.

Descriptors: *Water treatment, *Water softening, Hardness (Water), *Zeolites, Iron, Aeration, Chlorination, Phosphates, Hydrogen ion concentration, Filtration.

Identifiers: Softening capacity, Salt efficiency.

Well water of 46-grains hardness is reduced to 8 ppm hardness by zeolite filters, salt regenerated. Iron content is reduced from 0.5 to less than 0.1 ppm. Some hard water is bypassed so that water being distributed has a hardness of 5 grains per gallon, and iron content is always below 0.1 ppm. The well water is aerated on silt tray aerators to remove carbon dioxide before it passes to the zeolite filters. The salt used in regeneration averages 0.33 pounds per 1,000 grains hardness removed. In seven years of operation loss of zeolite has been very slight, equivalent to only 0.75 percent per annum. The zeolite has exactly the same softening capacity and salt efficiency and very nearly the same grain size, uniformity and moisture content now as when installed nearly seven years ago. Since installation of this softening plant no funds have been spent for parts or equipment. Chlorine is introduced after aeration and just prior to softening but the water softness has not been affected in any way. Effluent of the softening plant is treated with 5 ppm chemical phosphate which raises the pH to 7.8 and makes the water quite stable and completely passive to the piping system. (Bean-AWWARF) W73-11665

IMPROVED WATER AT LOWER COST PRODUCED WITH COAGULANT AID,

Bloomington Waterworks, Ind.

I. L. Dickstein.

Water Works Engineering, Vol 115, No 4, p 266-268 and 292-293, April 1962. 2 tab.

Descriptors: *Water treatment, Sanitary engineering, *Filtration, Design, Turbidity, *Electrolytes, Head loss, Costs, Cleaning.

Identifiers: Alum, Backwashing, Coagulant aid, Bloomington (Indiana).

Coagulant aid in the Bloomington, Indiana water treatment plants has produced a major cost-saving through reduction in alum dosage required; a 100 percent increase in length of filter runs; and ability to handle the peak loads presently being placed upon the plants. The reduction in alum cost exceeds the cost of the coagulant aid. During the summer months there does not seem to be any remarkable decrease in turbidity of settled water but the character of the solids passing onto filters is more porous, causes less clogging and requires less backwash water. For the first time water in the clear well lost all evidence of haziness after start of coagulant aid dosage, with Mogul Claracel. The material is a liquid and is fed by a simple gravity drip-feed arrangement. In an old plant the feed is added in the flocculation section of the mixers. In a new plant, it is applied to the inner cone of the clarifier near the mixing paddle. (Bean-AWWARF) W73-11666

60-MGD MICROSTRAINING PLANT MEETS DENVER'S GROWING NEEDS,

Denver Board of Water Commissioners, Colo.

G. J. Ture.

Water Works Engineering, Vol 114, No 12, p 1054-1056 and 1081, December 1961. 3 fig, 1 tab.

Descriptors: *Water treatment, *Filtration, *Algae, *Turbidity, Treatment facilities, Costs, Design, Colorado.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

Identifiers: *Microstraining, Denver (Colorado).

To meet spiraling water demands, Denver, Colorado, built a 60 mgd microstraining plant. It costs considerably less than a rapid sand filter installation; space requirements are much less; and operating costs will be lower, particularly since the staff of the adjacent existing filter plant will be able to operate the new facility. It consists of 12 units each 10 ft in diameter and 10 ft long. The water is low in basic turbidity, but subject to high algal infestation. The algae are removed by the microstrainers. Turbidity produced is not as low as that produced by the standard plant but is well within the limit of the U.S. Public Health Drink Water Standards. A table indicates the average turbidity of the strained water over 24 months is 2.2, reduced from 3.5 in the raw water. (Bean-AWWARF)
W73-11667

SYSTEMS APPROACH TO TRAINING AND LICENSING OF WATER WORKS PERSONNEL IN ONTARIO,

Ontario Water Resources Commission, Toronto. A. B. Redekopp, and J. H. Austin.
Ontario Water Resources Commission, Toronto, Ontario, Canada, circa 1972. 17p, 3 fig.

Descriptors: *Water works, *Personnel, *Training, Personnel management, Engineering education, Water treatment, Permits, Systems analysis, Canada.

Identifiers: *Toronto (Ontario).

Past methods of training water works personnel "by the seat of the pants" is no longer satisfactory in today's advanced water treatment plants. A scientific system, or systems approach, must be taken to provide organized training in both theory and "hands-on" equipment training. Along with training should be a licensing program. Such a training and licensing program will increase the usefulness of the personnel, result in a more professional staff, and provide assurance to the public that the staff is qualified. The program should cover all aspects of plant operation and should allow the men to proceed at the pace and level that they are able to maintain. Training should maximize the use of modern media to approximate reality as closely as possible and the staff of the training center should be experts in their subject areas. (Poertner)
W73-11676

OZONE FOR SUPPLEMENTARY WATER TREATMENT,

Metropolitan Corp. of Greater Winnipeg (Manitoba). Water Works and Waste Disposal Div. R. C. Sommerville, and G. Rempel.

Preprint of a paper presented at the American Water Works Association Annual Meeting, Denver, Colorado, June 15, 1971. 19 p, 3 fig, 2 tab. (Hill-EPA)
W73-11062

Descriptors: *Ozone, *Water treatment, *Feasibility studies, Water supply, Municipal water, Water works, Water resources development, Cost analysis, Disinfection, Pretreatment (Water), Filtration, Canada.

Identifiers: *Winnipeg (Manitoba), *Supplementary treatment.

Several types of treatment were studied for supplying pure water to Winnipeg in future years. Ozonation, as used in France, Scotland and Ireland, was found to be up to 75 percent cheaper to operate than conventional treatment because power is relatively cheap (0.7 cents/kwh). A two-year testing program of ozonation along with microstraining, alum treatment, and filtering was undertaken. Ozone is injected into the water after microstraining and sent to a contact tower for a retention period of about 5 minutes. The water is then filtered or, in some instances, alum is added before filtration. The ozone dosage depends upon

a number of factors including: (1) oxidizable matter in the water, (2) efficiency of emulsification, (3) water temperature, (4) Ozone concentration, (5) contact time and (6) residual required. Dosages of from 2 to 5 mg/l of Ozone were usually used with residuals of at least 0.1 mg/l. Although color removal was excellent, algae removal depended upon the type of algae and ranged from 65 to 75 percent reductions for Oscillatoria and Anabaena to only 10 percent reductions for Coelastrum. Total disinfection was not always achieved even with an Ozone residual, and the water was never disinfected if a residual was not present. (Poertner)
W73-11677

5G. Water Quality Control

EVALUATION OF POLLUTION ABATEMENT PROCEDURES MORAINA STATE PARK, Gwin, Dobson and Foreman, Inc., Altoona, Pa. J. W. Foreman, and D. C. McLean.

Copy available from GPO Sup Doc as EPL23/2-73-140, \$1.00; microfiche from NTIS as PB-221 337, \$0.95. Environmental Protection Agency, Technology Series EPA-R2-73-140, January 1973. 41 p, 12 fig, 7 tab, 9 ref. EPA Grant 14010 DSC.

Descriptors: *Mine drainage, *Pennsylvania, *Sealants, *Cost analysis, Acid mine water, Pollution abatement.

Identifiers: *Moraine State Park (Penn), Lake Arthur, Mine sealing, Surface mines, Bulk head seals.

Various mine drainage pollution abatement techniques completed during the construction phase of the Moraine State Park, Pennsylvania, were evaluated. The remedial methods employed included strip mine reclamation, underground mine sealing, grouting, surface sealing, refuse pile removal and oil and gas well plugging. Results of the underground mine hydraulic sealing and grouting work indicate an overall reduction in discharge flow rates from 146 to 57 gallons per minute, an overall reduction in net acidity from 501 to 160 pounds per day. The hydraulic sealing costs ranged from a low of \$8,308 to a high of \$38,437 per seal, for an average cost of \$19,480 per seal. Before and after data for the strip mine reclamation projects indicate a minor net decrease in the average discharge flow rates from 142 to 136 gallons per minute, an overall reduction in acidity from 50 to 22 pounds per day. The strip mine reclamation costs ranged from a low of \$420 to a high of \$2700 per acre, for an average of \$1455 per acre. (Hill-EPA)
W73-11062

THE DEVELOPMENT AND DEMONSTRATION OF AN UNDERWATER OIL HARVESTING TECHNIQUE, JBF Scientific Corp., Burlington, Mass. R. A. Bianchi, and G. Henry.

Copy available from GPO Sup Doc as EPL23/2-73-205, \$1.25; microfiche from NTIS as PB-221 431, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-205, April 1973. 86 p, 36 fig, 6 tab, 51 ref. EPA Project 15080 FWL, Contract 14-12-899.

Descriptors: Water pollution control, Oil pollution, *Oil spills, *Pollution abatement, *Massachusetts.

Identifiers: *Mechanical clean up, Oil spill clean up, *Oil recovery systems.

Analytical studies and harbor tests were conducted to determine the feasibility of harvesting oil beneath the surface of the water with the use of inclined planes. The analytical and laboratory investigations provided basic information to design and build units and showed that this kind of device

could harvest both light and heavy oils between 3/4 knot and 2 knots. Information was obtained regarding the geometry of the device. Tests showed that oil could be collected in waves without seriously affecting efficiency. A 22-foot-long unit was designed, built, and demonstrated in Boston Harbor. The results showed that the fixed-plane concept is highly effective in areas where the vessel can travel through the slick. Recovered oil is virtually water free and the unit recovered between 70% and 85% of the oil presented to it. The fixed inclined plane (SHOC) demonstrator unit works between 3/4 knot and 2 knots. To extend the velocity range down to zero knots and over 2 knots, it is recommended that a moving inclined plane be used. It is also recommended that a set of effective sweeps be investigated and developed. (EPA)
W73-11063

DEVELOPMENT OF A MOBILE SYSTEM FOR CLEANING OIL-CONTAMINATED BEACHES, Ecological Research Corp., Miami, Fla. F. X. Dolan, and J. P. Bowersox.

Copy available from GPO Sup Doc as EPL23/2-73-233, \$1.25; from NTIS as PB-221 432, \$3.25 in paper copy, \$0.95 in microfiche. Environmental Protection Agency, Technology Series Report EPA-R2-73-233, May 1973. 92 p, 22 fig, 7 tab, 12 ref.

Descriptors: *Oil spills, *Separation techniques, Beaches, Oil-water interfaces, Oil pollution, *Pollution abatement.

Identifiers: *Sand washing, Liquid-liquid separation, *Hydrocyclones, *Oil-water separation.

A system has been developed for the restoration of oil-contaminated beach sands. The method involves washing the sand in a high energy jet contractor washer and separation of the cleaned sand from the washing fluid in a conventional solid-liquid cyclone. Separation and concentration of the oil-water effluent from the washing process is also accomplished in cyclones. The two separate stages of this process have been demonstrated on a pilot scale equivalent to about 3 tons of wet, oil contaminated sand per hour. The sand washing process has been shown capable of removing over 99% of the contaminant oil from a simulated beach sand. Oils used were No. 4 and No. 6 fuel oil at 4 to 8% of the dry weight of the sand. The oil-water separation tests yielded a highly enriched oil product stream with less than 20% water, while the water removed from the system was suitable for recycle to the sand washing system. A conceptual design for a mobile beach cleaning system based on the processes studied is presented and is shown to be feasible within the state-of-the-art. (EPA)
W73-11064

OXIDATION OF PYRITES IN CHLORINATED SOLVENTS, NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div. For primary bibliographic entry see Field 05D. W73-11068

DEVELOPMENT AND PRELIMINARY DESIGN OF A SORBENT-OIL RECOVERY SYSTEM, Hydronautics, Inc., Laurel, Md. E. Miller, L. Stephens, and J. Ricklis.

Copy available from GPO Sup Doc as EPL23/2-73-156, \$2.60; microfiche from NTIS as PB-221 497, \$0.95. Environmental Protection Agency Technology Series Report, EPA-R2-73-156, January 1973. 191 p, 69 fig, 36 tab, 2 ref. EPA Project 15080-HEV.

Descriptors: *Oil spills, Water pollution treatment, *Design criteria, *Laboratory tests, *Secondary recovery (Oil), Pollution abatement, Water pollution control, Conveyance structures.

Identifiers: *Soil-oil recovery system, Sorbents.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

A development program was completed and preliminary designs were prepared for 3000 gallon/hour protected water and 10,000 gallon/hour unprotected water Sorbent Oil Recovery Systems. The five phases in the development program were: (1) characterization of the sorbent material, (2) the development of the sorbent broadcasting system, (3) the development of the harvesting conveyor and evaluation of overall recovery performance, (4) the development of the sorbent regeneration system and (5) model tests of a 1/4-scale model recovery platform. The development program showed that a continuous sorbent-oil recovery system is feasible using 30 or 60 PPI polyurethane sorbent chips. In one pass about 90 percent of the oil in a 1.5 mm slick can be recovered. The water content of the recovered fluid is less than 10 percent. The preliminary designs are presented with detailed descriptions of the system components, operating procedures, and costs. (EPA)

W73-11071

ANALYSIS OF ENGINEERING ALTERNATIVES FOR ENVIRONMENTAL PROTECTION FROM THERMAL DISCHARGES.

Washington State Water Research Center, Pullman.

Copy available from GPO Sup Doc as EPL23/2:73-161, \$2.60; microfiche from NTIS as PB-221 498, \$0.95. Environmental Protection Agency, Technology Series Report, EPA-R2-73-161, March 1973. 228 p, 15 fig, 17 tab. EPA Project 16130 FLM.

Descriptors: *Thermal powerplants, *Thermal pollution, Mathematical Models, *Alternative planning, *Decision making, Sites, Intakes, *Environmental control, Chemical wastes, Water temperature, Cooling water, Water pollution effects, Environmental effects.

A decision tree framework was utilized to integrate engineering decisions concerned with the control of environmental impacts from stationary thermal power plants. The engineering costs and the ecological response of fish communities to any sequence of decisions in the tree can be computed with the models developed in this study. A series of formulations were also developed to describe the environmental impact of siting a series of power plants in a region. Both the static and dynamic models require verification before they are applied. Impacts of thermal and chemical discharges to the receiving waters and mechanical damage from screening devices are modeled. (EPA)

W73-11078

THE NORTHERN MAINE REGIONAL TREATMENT SYSTEM,

Northern Maine Regional Planning Commission, Presque Isle.

For primary bibliographic entry see Field 05D.

W73-11079

PROGRESSIVE TAXATION AS A POLICY FOR WATER QUALITY MANAGEMENT,

California Univ., Riverside. Dept. of Economics.

T. A. Ferrar.

Water Resources Research, Vol 9, No 3, p 563-568, June 1973. 3 fig, 5 ref.

Descriptors: *Water resources, *Water quality, *Management, *Pollution taxes (Charges), *Water quality standards, Effluents, Pricing, Waste disposal, Resource allocation, Mathematical models, Systems analysis, Optimization.

Identifiers: *Cost minimization.

Recent literature on environmental control and water resources management has advocated the allocative efficiency associated with standard effluent taxation control measures. This article demonstrates that the operational characteristics

of such techniques tend to render them impotent as standard maintenance measures: The significant operational weakness is a fundamentally static applicability. Since most acute environmental problems occur in vigorously developing metropolitan areas, the concept of a linear, static equilibrium charge is meaningless in such dynamic settings. A new, nonlinear effluent taxation structure is proposed that alleviates this weakness by incorporating a progressive taxation schedule that is tied to water quality standards. An allocation model is outlined, and the rationing procedure involves an incentive-feedback algorithm that iteratively allocates the available environmental resource among the polluters in accordance with a cost minimization objective. (Bell-Cornell)

W73-11147

COST-EFFECTIVENESS METHODOLOGIES FOR DATA ACQUISITION IN WATER QUALITY MANAGEMENT,

Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.

R. C. Ward, and D. H. Vanderholm. Water Resources Research, Vol 9, No 3, p 536-545, June 1973. 3 fig, 4 tab, 10 ref.

Descriptors: *Water quality, *Management, *Methodology, *Data collections, *Evaluation, *Costs, *Colorado, Design, Model studies, Streams, Simulation analysis, Systems analysis, Mathematical models.

Identifiers: *Grab-sampling, *Cost-effectiveness, *Data acquisition.

Current water quality management procedures are established in such a manner that they require sound data for effective action. In establishing the regulatory procedures, much emphasis has been placed on the water criteria, whereas little emphasis has been given to developing ways and means to provide meaningful data to enforce the criteria. This study develops methodologies that permit the rational evaluation and design of data acquisition system alternatives for water quality management. This necessarily includes an evaluation of the cost of a data acquisition system and its effectiveness. The evaluation and design procedure of the water quality data acquisition system is based on two major points. First, the strategy used by the managing agency must be related to a specific type or form of data. Second, the character of the streams to be managed must be carefully delineated. To relate these two points to some measure of system effectiveness, a data acquisition model is developed which relates grab-sampling frequency to the detection of pollution events. By then determining the cost of various sampling frequencies, cost-effectiveness relationships can be developed. The procedure is applied to the State of Colorado. (Bell-Cornell)

W73-11150

AN ENVIRONMENTAL EVALUATION SYSTEM FOR WATER RESOURCE PLANNING,

Battelle Columbus Labs., Ohio.

For primary bibliographic entry see Field 06A.

W73-11151

ENVIRONMENTAL CONSERVATION,

For primary bibliographic entry see Field 06G.

W73-11170

ENVIRONMENTAL HAZARDS IN THE CONTROL OF DISEASE VECTORS,

Florida State Div. of Health, Vero Beach. Entomology Research Center.

For primary bibliographic entry see Field 05C.

W73-11182

ENVIRONMENT,

Colorado School of Mines, Golden. Research Inst.

For primary bibliographic entry see Field 05C.

W73-11183

MINERAL INDUSTRY VS. ECOLOGY.

Mining Engineering, Vol 23, No 8, p 51-60, August 1971. 6 fig, 7 tab, 28 ref.

Descriptors: *Mineral industry, *Environmental effects, Air pollution, Solid wastes, Water pollution, Ecology, Mining, Mine waters, Safety, Hazards, Human pathology, Ventilation, Molybdenum, Heavy metals, Metals, Waste water treatment, Oil.

Identifiers: Silicosis, Pneumoconiosis.

All aspects of human environment effectively connected with the mineral industry are discussed. Pneumoconiosis as a result of coal mining is under control in a modern mine, however it is still a threat as is the case with silicosis in metal mines. Instrumentation protecting people from these hazards is described. Basic ways in which surface mining disturbs the land are spoil banks, high walls, toxic soil and waste disposal. Results of recent Kennecott tailings stabilization tests are presented. Water pollution problems are in urgent need for attention particularly in metal industries. Magnetic agglomeration seems to be a promising method for classification and separation of metallics in solid wastes, as well as in treatment of steel industry waste waters. Air pollution control measures are also presented. (Oleszkiewicz - Vandebilt)

W73-11185

A STUDY OF THE FLINT RIVER, MICHIGAN, AS IT RELATES TO LOW-FLOW AUGMENTATION,

Geological Survey, Lansing, Mich.

G. C. Hubert.

Open-file report, February 1972. 24 p, 7 fig, 3 tab, 5 ref.

Descriptors: *Low-flow augmentation, *Low flow, *Streamflow, *Michigan, Data collections, Water quality control, Conjunctive use, Discharge (Water).

Identifiers: *Flint River (Mich.).

Streamflow characteristics of the Flint River and its tributaries are described, and draft-storage relations are given for the river basin. At 17 sites, the 7-day, 2-year low flow ranges from 0 to 0.17 cfs per square mile. Existing storage, if fully utilized, could provide a minimum discharge at Montrose of 160 cfs in 19 years. Low flows, in conjunction with water diverted from Lake Huron to the Flint River through the Detroit and Flint water systems (about 60 cfs in 1971), would seldom be less than about 200 cfs at Montrose. Diversions from the basin for irrigation may reduce low flows by about 12 cfs. Groundwater sources offer small potential for streamflow augmentation. (Knapp-USGS)

W73-11207

INDUSTRIAL WASTE SURVEY, DADE COUNTY, FLORIDA.

Federal Water Quality Administration, Fort Lauderdale, Fla. Lower Florida Estuary Study.

For primary bibliographic entry see Field 05B.

W73-11217

METHOD OF REMOVING OIL FROM WATER,

Basf-Wyandotte Chemical Corp., Mich. (assignee) J. V. Otrubek.

U. S. Patent No. 3,729,411, 3 p, 3 ref; Official Gazette of the United States Patent Office, Vol 909, No 4, p 1354, April 24, 1973.

Descriptors: *Patents, *Oil spills, *Oil pollution, Separation techniques, Water pollution control, Water quality control, *Pollution abatement, *Absorption.

Identifiers: Agglomeration, *Volcanic ash.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

Silicone treated expanded volcanic ash is cast directly on to the oil film and around it. It absorbs oil forming agglomerates which can be picked up with relative ease. The ash is prepared by spraying expanded ash with a silicone emulsion, consisting essentially of 20 parts by weight of water per weight of emulsion, at a temperature ranging from 300-1500°F and in an amount ranging from 25 to 400 cc of emulsion per cubic foot of ash. (Sinha-OEIS) W73-11225

DE-OILING OF POLLUTED WATERS.
Agence Nationale de Valorisation de la Recherche, Courbevoie (France). (assignee)
For primary bibliographic entry see Field 05D.
W73-11226

WATER PURIFICATION WITH POROUS ABRASIVES.
Norton Co., Troy, N.Y. (assignee)
For primary bibliographic entry see Field 05D.
W73-11228

VACUUM SKIMMING APPARATUS FOR REMOVING LIQUID CONTAMINANTS FLOATING IN CONFINED BODIES OF WATER.
D. M. Horne, W. H. Heyser, and H. M. Neely.
U. S. Patent No. 3,727,766, 5 p., 3 fig., 7 ref.; Official Gazette of the United States Patent Office, Vol 909, No 3, p 937, April 17, 1973.

Descriptors: *Patents, *Skimming, *Oil spills, *Oil pollution, Equipment, Barges, Water quality control, Harbors, Bays, Water pollution control, *Pollution abatement.

The apparatus includes a boat or barge containing at least a vacuum tank and a holding tank. The vacuum tank is vacuumized to 15 to 20 inches Hg by one or more water jet eductors which are operated by a high pressure pump drawing clean water from beneath the boat. One or more sets of vacuum hoses and suction heads are connected to the vacuum tank. The boat operators manipulate the hoses to skim the surface. The use of eductors is considered a safety device. Any overflow condition of the vacuum tank will be discharged directly through the eductors into the overboard discharge without flooding its pump and causing a loss of prime. This should afford the safe disposition of any volatile gases from petroleum type contaminants that may exist in the vacuum or holding tanks. (Sinha-OEIS)
W73-11232

SKIMMING DEVICE FOR USE ON A LIQUID SURFACE.
Gulf Oil Corp., Pittsburgh, Pa. (assignee)
For primary bibliographic entry see Field 05D.
W73-11233

WASTE WATER SAMPLER.
Tri-Aid Sciences, Inc., Rochester, N.Y. (assignee).
For primary bibliographic entry see Field 05A.
W73-11243

ENVIRONMENTAL HEALTH PLANNING.
Bureau of Community Environmental Management, Rockville, Md.

Available from the National Technical Information Service as PB-213 375. Community Environmental Management Series. 1971. 139 p., 180 ref.

Descriptors: *Environmental sanitation, *Public Health, *Planning, *Programs, Air pollution, Water quality, Solid wastes, Radiation, Noise, Vectors, Pesticides.
Identifiers: Environmental Health, Public Health Service, Bureau of Solid Waste Management (BSWM).
W73-11252

There is a great need for planning guidelines to help state and local administrators formulate environmental health programs. This report is partly the result of a meeting among representatives of each major environmental health program of the Public Health Service and of various professional environmental health organizations to crystallize objectives and concepts for program formulation. The emphasis of the report is on a systematic approach to the planning of each environmental health program and to the overall coordination of these programs. Program areas covered in the report include air, water, solid wastes, radiation, noise, vectors, pesticides, recreation, food, drugs, and occupational health. Within the water program the primary concern was for the protection of human health through the maintenance of high levels of water quality. This depends largely on more periodic inspection of water treatment plants, better trained operators, and expansion of overloaded facilities. (Elfers - North Carolina)
W73-11244

SCOPE OF PUBLIC WATER SUPPLY NEEDS.
New York State Temporary Commission on the Water Supply Needs of Southeastern New York, Albany.
For primary bibliographic entry see Field 06D.
W73-11245

BROWN COUNTY SEWAGE AND SOLID WASTE STUDY - 1972.
Brown County Regional Planning Commission, Green Bay, Wis.
For primary bibliographic entry see Field 05E.
W73-11250

HOUSING AND PLANNING REFERENCES.
Department of Housing and Urban Development, Washington, D.C.
For primary bibliographic entry see Field 03D.
W73-11251

REGIONAL WASTE WATER, SOLID WASTE DISPOSAL, WATER SUPPLY, AND STORM DRAINAGE SYSTEMS APPRAISAL.
Harza Engineering Co., Chicago, Ill.

Prepared for Tri-County Regional Planning Commission: Peoria, Tazewell and Woodford Counties, Illinois, February, 1970. 91 p., 3 fig., 8 tab, 3 map, 68 ref. HUD III-P-293.

Descriptors: *Planning, *Waste water disposal, Solid wastes, Water supply, Storm water, Administration, Financing, Non-structural alternatives, *Illinois.
Identifiers: Interim guidelines, *Study design, *Utility extension planning.

This comprehensive report consists of three basic parts: the formulation of interim review guidelines to be used in reviewing local applications for federal grants; the evaluation of the existing systems; and a proposed study design for further investigations and the preparation of a comprehensive plan. The review guidelines are based on the objectives that the services be adequate to protect health and safety, that planning and construction of new facilities be economically efficient, and that these facilities be compatible with the natural environment. The evaluation of the existing systems including analyses of demands, opportunities, and administration found that the improvement of the waste water and solid waste disposal systems had the highest priority. The study design emphasizes objectives, planning procedures, work schedules, budgetary requirements, and detailed outlines of what should be included in the comprehensive plans. Non-structural measures are emphasized in addition to the usual structural systems. (Elfers-North Carolina)
W73-11252

QUALITATIVE VALUES IN ENVIRONMENTAL PLANNING: A STUDY OF RESOURCE USE IN URBANIZING WATERSHEDS,
Harvard Univ., Cambridge, Mass., Dept. of Landscape Architecture.

P. Rogers, and C. Steinitz.
Available from the National Technical Information Service as AD-751 228. U.S. Army Corps of Engineers, New England Division, Walham, Mass., October, 1969. 95 p., 24 fig., 9 tab, 15 ref, 3 append. DACW-33-DC-0151.

Descriptors: *Environmental effects, *Urbanization, *Systems analysis, Urban runoff, Aesthetics, *Simulation analysis, Computer models, Regression analysis.

Identifiers: *Charles River Basin, Environmental planning, Visual quality.

The use of systems analysis methods and models to describe the process of urbanization and to determine its effects upon the quality of the environment is presented. The report is divided into three distinct parts. Part I is a discussion of the current state of the art in urban systems analysis and model building, particularly in relation to making public investment decisions. Present models and techniques have not generally incorporated aspects of environmental quality such as aesthetics or the natural capacity of a watershed to control flood flows. Part II describes a simulation model to enable planners to quickly determine the impact of urbanization on the runoff of a watershed. The model uses such factors as land use, storm sewers, and infiltration to determine peak flows. The model is an extension of the rational method and was applied to a portion of the Charles River Basin. Part III includes detailed appendices on the computer programming procedures. Part III describes a method for evaluating the visual consequences of urbanization on shoreline landscapes. Questionnaires were used to test the importance of several visual variables related to vegetative cover, land use, color, tone, and natural quality. It was found through regression analysis that the visual quality of a landscape can be predicted by a few key variables such as vegetative opacity. (Elfers-North Carolina)
W73-11253

COMMUNITY IMPROVEMENTS AND SERVICE COSTS,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 03D.
W73-11255

PUBLIC UTILITIES IN WINNEBAGO COUNTY.
City-County Planning Commission, Rockford, Ill.
For primary bibliographic entry see Field 03D.
W73-11263

COLORADO RIVER WATER QUALITY IMPROVEMENT PROGRAM.
Bureau of Reclamation, Washington, D.C.

February 1972, 88 p., 5 fig., 6 tab.

Descriptors: *Colorado River basin, *Water quality control, *Salinity, *Irrigation water, Mineral water, Quality control, Desalination, Weather modification, Geothermal studies.
Identifiers: *Point source control, *Diffuse source control, *Western U.S. Water Plan.

Waters of the Colorado River are becoming more saline; at the headwaters the average salinity (concentration of total dissolved solids) in the Colorado River is less than 50 mg/l and progressively increases downstream until, at Imperial Dam, the present modified condition is 865 mg/l. Projections of future salinity levels without a control program suggest that values of 1,250 mg/l or more will occur at Imperial Dam by the year 2000. One projection used in the Lower Colorado Re-

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

gion Comprehensive Framework Study foresees such a level being reached by 1980. Should these increases in salinity levels occur, the agriculture in the Imperial, Coachella, Gila, and Yuma Valleys would be further threatened. Also, a poorer water quality would be diverted to the Metropolitan Water District of Southern California and the Las Vegas Valley Water District, causing further economic losses to the very large block of domestic water users in California and Nevada. Upon completion of the Central Arizona Project, water users in the Phoenix and Tucson areas would be similarly affected. A comprehensive 10-year Water Quality Improvement Program has been structured and integrated with programs involving weather modification, geothermal resources, desalting, and the Western U.S. Water Plan. These programs, when implemented, could maintain salinity in the lower main stem at or below present levels. (OWRR)

W73-11264

CELL SYSTEMS KEEP MERCURY FROM ATMOSPHERE.

Chemical and Engineering News, Vol 50, No 7, p 14-15, February 14, 1972. 1 fig.

Descriptors: *Mercury, *Pollution abatement, *Air pollution, Industrial production, *Industrial wastes, Chemical wastes, Waste water treatment, Adsorption.

Two systems for reducing the amount of mercury that escapes in liquid waste streams and in vapor are compared. One, developed in the United Kingdom by BP Chemicals International incorporates a chemical scrubbing step to scavenge mercury from vent gases coming from electrolysis cells. The technique reportedly attains a removal efficiency of 95 to 99%. Monsanto in the United States has introduced a new adsorption system using canisters with a special proprietary adsorbent, which in the laboratory yielded removal efficiencies greater than 99.99%. Best operating efficiencies are achieved by teaming the adsorbent system with Brink mist eliminators, which will pretreat the gas stream with 90-99% efficiency. (Oleszkiewicz-Vanderbilt)

W73-11287

A CONTROL SYSTEM FOR MILL EFFLUENT DISPOSAL,

Bowaters Southern Paper Corp., Calhoun, Tenn.

J. K. Powell.

Tappi J Tech Assoc Pulp Pap Ind. Vol 55, No 4, p 519-523, 1972. Illus.

Identifiers: *Control system, Effluents, Flow, Velocity measurement, *Mill effluents, Rivers, Transmitter, *Pulp wastes, Waste disposal.

A method of automatically controlling the discharge of effluent from a paper mill to a river was developed. The effluent from the mill is admitted to a river through a submerged, motorized, automatically controlled gate. The effluent flow is ratioed to the actual river flow in order to discharge the optimum amount of effluent at all times. The primary problem encountered with this control system was in the measurement of river velocity and, consequently, river flow. The problem was satisfactorily solved by using a magnetic flow transmitter for river velocity measurement. A number of advantages have been realized since the conversion to automatic control: the measurement of the river flow is continuous and more accurate, an optimum ratio of effluent discharge to river discharge can be maintained at all times, and an increase in the quantity of effluent discharged has in effect increased the effluent storage reservoir capacity. (Copyright 1972, Biological Abstracts, Inc.)

W73-11312

TASTE AND ODOR CONTROL IN WATER,

Mississippi State Univ., State College, Dept. of Sanitary Engineering.

For primary bibliographic entry see Field 05F.

W73-11318

POSSIBILITY OF REDUCING NITROGEN IN DRAINAGE WATER BY ON FARM-PRACTICES, (BIO-ENGINEERING ASPECTS OF AGRICULTURAL DRAINAGE, SAN JOAQUIN VALLEY, CALIFORNIA).

Bureau of Reclamation, Fresno, Calif.

For primary bibliographic entry see Field 05B.

W73-11324

AERIAL SURVEILLANCE SPILL PREVENTION SYSTEM,

McDonnell Aircraft Co., St. Louis, Mo. Renaissance Lab.

For primary bibliographic entry see Field 05B.

W73-11326

NUMERICAL THERMAL PLUME MODEL FOR VERTICAL OUTFALLS IN SHALLOW WATER,

Oregon State Univ., Corvallis, Dept. of Mechanical and Nuclear Engineering.

For primary bibliographic entry see Field 05B.

W73-11333

ECONOMIC FEASIBILITY OF MINIMUM INDUSTRIAL WASTE LOAD DISCHARGE REQUIREMENTS,

Datagraphics, Inc., Pittsburgh, Pa.

For primary bibliographic entry see Field 05D.

W73-11335

CONTROL OF HAZARDOUS CHEMICAL SPILLS BY PHYSICAL BARRIERS,

MSA Research Corp., Evans City, Pa.

J. V. Friel, R. H. Hiltz, and M. D. Marshall.

COPY available from GPO Sup Doc as EPI.23/2-73-185, \$1.25; microfiche from NTIS as PB-221 493, \$0.95. Environmental Protection Agency, Technology Series Report number, EPA-R2-73-185, March 1973. 91 p., 16 fig., 14 tab., 8 ref. EPA 15090 HGP. 68-01-0100.

Descriptors: *Barriers, *Dikes, *Dams, *Water pollution treatment, *Water pollution control, Hazards, Chemicals, Accidents.

Identifiers: *Spills, *Hazardous materials, Hazardous chemicals.

The magnitude of potentially hazardous chemicals now being transported through the country poses a serious threat to the water eco-system. Unless spills can be controlled at their source, movement into the water system may be inevitable. Such control dictates the availability of systems capable of forming dikes or flow diverting barriers either as a portable system carried on the vehicle or a mobile unit rapidly deployable to the site. In this regard, a program was instituted to investigate the applicability of foamed materials for forming such dikes and barriers. It was successfully demonstrated that polyurethane could be packaged in a portable unit and dispensed as a low density rigid foam capable of diking liquids on a variety of substrates. Attempts to develop a rigid high expansion system were not fully successful. A foamed concrete system was also successfully evolved, which used mobile equipment to build free form dikes. Modified surfactant foam was also shown to be an effective cover over spilled chemicals to control vapor release and fire hazards. In each case, a field tested unit was demonstrated or shown to be feasible. (EPA)

W73-11338

LEAST COST METHOD FOR SEWER DESIGN,

Camp, Dresser and McKee, Boston, Mass.

S. Walsh, and L. C. Brown.

Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 99, No EE3, Proceedings paper 9796, p 333-345, June, 1973. 4 fig., 4 tab., 3 ref.

Descriptors: *Computers, *Dynamic programming, *Sewers, *Design, *Construction costs, *Environmental engineering, Methodology, Constraints, Sanitary engineering, Optimization, Feasibility studies, Mathematical models, Systems analysis.

Identifiers: *Vertical alignment.

Engineers have achieved significant reductions in construction costs of wastewater collection systems with the use of computers. Even greater savings can be achieved by improving the method of integrating pipes into a collection system utilizing the technique of dynamic programming. A new computerized method of sewer design uses the conventional design constraints of minimum ground cover, critical invert elevations, and minimum and maximum velocities to establish a region of feasible solutions for each pipe. It treats the problem of integration of each pipe into one collection system as a sequential decision process solved by the dynamic programming algorithm. Not only is the least cost design generated, but a range of alternative discharge elevations and associated costs are made available to the engineer, allowing him maximum flexibility in exercising his judgment. Solutions of realistic sewer design problems show that the least-cost design is produced by this system. (Bell-Cornell)

W73-11360

MULTILEVEL CONTROL OF MULTIPOLLUTANT SYSTEM,

Case Western Reserve Univ., Cleveland, Ohio. Systems Research Center.

J. W. Foley, and Y. Y. Haimes.

Journal of Environmental Engineering Division, American Society of Civil Engineers, Vol 99, No EE3, Proceedings paper 9795, p 253-268, June, 1973. 7 fig., 2 tab., 19 ref.

Descriptors: *Water quality control, *Water pollution, *Treatment, *Effluents, *Pollution taxes (Charges), *Decision making, *Environmental engineering, Algae, Biochemical oxygen demand, Constraints, Cooling towers, Coordination, Dissolved oxygen, Optimization, Temperature, Sewage treatment, Mathematical models, Systems analysis, *Georgia.

Identifiers: *Chattahoochee River (Georgia), Decomposition.

The problem of maintaining water quality is considered. The Chattahoochee River, Georgia, is modeled in terms of BOD and temperature. The problem of determining optimal levels of treatment is iteratively solved using the multilevel approach which permits the inclusion of a Regional Authority, effluent charges, and decentralized decision making. The application of effluent charges has been extended to the case of nonlinear constraints. The coordination strategy of satisfying the Kuhn-Tucker conditions is essentially that of utilizing the economic law of supply and demand. The effluent charges are given in terms of pollution loads and hydrological characteristics. The multilevel approach allows constraints (which may be politically determined) to be explicitly incorporated into the objective function. Finally, numerical results are given for a tutorial example that illustrates the possible interactions between temperature and biochemical oxygen demand decisions and water quality constraints on maximum temperature levels, minimum dissolved oxygen levels, and maximum concentrations of algae. (Bell-Cornell)

W73-11363

ENVIRONMENTAL TERMINOLOGY INDEX.

Oak Ridge National Lab., Tenn. Environmental Information Systems Office.

For primary bibliographic entry see Field 10C.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

W73-11387

PRESERVATION OF LAKE BAYKAL (OB OKHRAZ OZERA BAYKAL),
Hydrometeorological Service of the USSR,
Moscow.
For primary bibliographic entry see Field 05C.
W73-11407

HELICOPTER APPLICATION OF COPPER SULFATE,
East Bay Water Co., Oakland, Calif.
For primary bibliographic entry see Field 05F.
W73-11419

THE EFFECTS OF DITCHING ON THE MOSQUITO POPULATIONS IN SOME SECTIONS OF JUNCUS SALT MARSH IN CARTERET COUNTY, NORTH CAROLINA,
North Carolina State Univ., Raleigh. Dept. of Entomology.
For primary bibliographic entry see Field 04A.
W73-11431

USING FIRE STREAMS WITH A SELF-PROPELLED OIL SPILL SKIMMER,
New York City Fire Dept.

A. C. Roberts.
Copy available from GPO Sup Doc as EP1.23/2:73-181, \$0.55; microfiche from NTIS as PB-221 542, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-181, May 1973. 27 p, 6 fig, 1 ref. EPA Project 15080 FVP.

Descriptors: Oil, *Boats, Currents (Water), *Docks, Nozzles, *Oil spills, Training, *Skimming, Water pollution control, Pollution abatement.

Identifiers: Surface currents, *Fire streams, *Booming, Herding, Fire departments.

Results are reported from field tests and operations conducted by the Marine Division of the New York City Fire Department in the fall of 1972. The objective of the operations was to develop tactics for operation of a fire boat in conjunction with a self-propelled oil skimming boat for oil spill cleanup with minimum use of booms. Streams from the fireboats were used to develop currents for propelling oil toward the skimmer, to maneuver oil in conjunction with natural currents, and to concentrate oil for subsequent pickup by the skimmer. (EPA)
W73-11434

USE OF FIRE STREAMS TO CONTROL FLOATING OIL,

New York City Fire Dept.

B. Katz, and R. Cross.

Copy available from GPO Sup Doc as EP1.23/2:73-113, \$0.75; microfiche from NTIS as PB-221 543, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-113, February 1973. 36 p, 6 fig, 2 ref. EPA Project 15080 FVP.

Descriptors: Oil spoils, *Turbulence, Eddies, Hydraulics, *Jets, Piers, Velocity, Pressure, Anchors, *Boats, Currents (Water), Docks, *Nozzles, Discharge, Training, Harbors, Inland waterways, Entrainment, Momentum transfer, Emulsions.
Identifiers: Surface currents, *Monitor streams, *Hose streams, Fire departments, Booming, Herding, Rip zone, Null current zone.

The substantial momentum output of large volume, high pressure water nozzles can be used to establish surface currents which are helpful in controlling floating oil. When these induced currents have components opposite to the ambient current, a turbulent rip zone is established where

the opposing currents cancel. It is mainly by means of this zone that oil slicks may be influenced in a useful way. An empirical relationship for the distance between the impact point of the stream and the rip zone, as a function of nozzle output and natural current speed, has been determined and compared with a theoretical prediction based on a simplified model. If the natural current is small, the rip zone's turbulence will be slight and it will be a barrier to approaching oil. If the natural current is large, the turbulence will be intense and the oil will be churned downward and pass under the zone. Techniques for the use of such large volume, high velocity water streams to control oil are described and their limitations are discussed. (EPA)
W73-11435

A SMALL VACUUM OIL SKIMMING SYSTEM,
New York City Fire Dept.

R. H. Cress.
Copy available from GPO Sup Doc as EP1.23/2:73-115, \$0.50; microfiche from NTIS as PB-221 544, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-115, February 1973. EPA Project 15080 FVP.

Descriptors: *Oil spills, *Skimming, *Oil-water interfaces, *Entrainment, *Harbors, Water pollution control, Pollution abatement.

Identifiers: *Vacuum skimming unit, Compressed air, Floating corner skimmer, Fire department, Emergency service, Oil-water separation, Herding.

The oil-slick collection system suitable for use on harbor craft is described. This system employs a pneumatic-powered vacuum cleaner to collect oil from the water surface by entrainment in a high-velocity air stream. The components are widely available commercial items. Tests show the system to be successful in picking up No. 4 fuel and lighter oils. The collection rate depends chiefly on the rate of oil supply to the skimmer. (EPA)
W73-11436

SHORE TERMINATION FOR OIL SPILL BOOMS,
New York City Fire Dept.

A. C. Roberts.
Copy available from GPO Sup Doc as EP1.23/2:73-114, \$0.50; microfiche from NTIS as PB-221 547, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-114, February 1973. 21 p, 3 fig, 1 ref. EPA Project 15080 FVP.

Descriptors: *Oil spills, *Harbors, Hydrodynamics, Riprap, Water pollution control, Pollution abatement, Oil pollution.

Identifiers: Containment boom terminator, *Oil seal, *Boom terminal gap, Construction details, *Booms.

One of the most common sources of failure in the application of floating oil booms to contain an oil spill is leakage between the end of the boom and the adjacent shoreline, deck or bulkhead. Booms cannot be fastened solidly to the shore since they must rise and fall with the changes in height due to tides and waves. The use of countercurrents generated by a fire stream or prop wash is attractive, although it ties up a boat often needed for other tasks. Furthermore, the shallow draft of a small boat allows oil to escape beneath the boat unless the boat is overlapped by the boom. Securing boom to the boat while avoiding the fouling of the boat's propeller then becomes operational concerns.

A simple structure is described for mounting a small outboard motor to 'seal' the gap. This boom terminator can be constructed on-scene with tools and materials generally available around the waterfront by relatively unskilled personnel. (EPA)
W73-11437

REMOVAL OF OIL FROM UNDER PIERS,
New York City Fire Dept.

B. Katz.

Copy available from GPO Sup Doc as EP1.23/2:73-116, \$0.65; microfiche from NTIS as PB-221 545, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-116, February 1973. 29 p, 3 fig, 2 ref. EPA Project 15080 FVP.

Descriptors: *Oil spills, *Oil pollution, Hydraulics, *Jets, *Piers, Docks, Boats, *Nozzles, *Emulsions, Entrainment, Pollution abatement, Water pollution control.

Identifiers: Fire departments, Surface currents, Monitor streams, Hose streams, Surface collecting agent.

While this report deals primarily with methods of extracting oil from under piers, it is recognized that simple extraction is not enough, and that the oil should also be removed from the environment. Therefore, considerable attention has been paid to driving the oil out in such a way that it can be picked up. The primary means of extraction are by the establishment of artificial currents under the contaminated pier, and a number of methods are suggested to cope with various types of pier substructure. Some other possible approaches, not involving flushing by artificial currents, are also discussed. These include: uses of chemicals, sinking, air entrainment and embankment. A generalized description of pier structures is also included. (EPA)
W73-11438

A RAPIDLY DEPLOYABLE OIL CONTAINMENT BOOM FOR EMERGENCY HARBOR USE,

New York City Fire Dept.

J. J. Cunningham.

Copy available from GPO Sup Doc as EP1.23/2:73-112, \$0.65; microfiche from NTIS as PB-221 523, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-112, February 1973. 31 p, 2 fig, 6 ref. EPA Project 15080 FVP.

Descriptors: *Oil spills, *Harbors, Water pollution control, Pollution abatement.

Identifiers: *Oil spill containment boom, Fire department, *Emergency service, Performance criteria, Quiescent water, *Booms.

Performance criteria are described for an ideal oil spill containment boom for emergency harbor service. The type of boom recommended is that which an emergency service, such as a fire department or a plant team could transport promptly to a spill incident within a harbor and deploy quickly to contain the spilled oil. The experience acquired by the Marine Division of the NYFD over the course of one year, both at active spill control operations and in test exercises, serves as the principal source of information. It is hoped that information offered will lead to the development of the ideal boom as envisioned. Among the boom criteria developed are: recommended size and performance capabilities; storage and handling problems; and optimum design characteristics. (EPA)
W73-11439

NATIONAL MEAT-PACKING WASTE MANAGEMENT RESEARCH AND DEVELOPMENT PROGRAM,
Robert S. Kerr Environmental Research Lab., Ada, Okla.

For primary bibliographic entry see Field 05D.
W73-11440

PREDICTION MODELING FOR SALINITY CONTROL IN IRRIGATION RETURN FLOWS,
Robert S. Kerr Environmental Research Lab., Ada, Okla.

A. G. Hornsby.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

Copy available from GPO Sup Doc as EP1.23/2:73-168, \$0.90; microfiche from NTIS as PB-221 647, \$0.95. Environmental Protection Technology Series Report EPA-R2-73-168, March 1973. 35 p, 6 fig, 101 ref. EPA Project 13030 GJS.

Descriptors: *Irrigation systems, Surface flow, Subsurface flow, Salt movement, Ion exchange, System analysis, Water resources, Management, Evapotranspiration, Soil physical properties, Soil moisture, *Reviews, *Return flow, *Salinity, Model studies, *Water management (Applied).

A review of the current state-of-the-art of prediction modeling as applied to salinity control in irrigation return flows is presented. Prediction models are needed to assess the effects of proposed changes in irrigation management practices on the quality of return flows. The processes which affect salinity levels in return flows are enumerated and their interactions are alluded to. Models used to predict the quantity and quality of return flows are briefly discussed to show the development of the current level of technology. The reader is referred to the original documents for more rigid development of the models and incumbent assumptions. It was concluded that technology of water and salt flow in soil systems is sufficiently developed to permit formulation of models using systems analysis to evaluate proposed changes in management practices. Development of systems models to study irrigation return flow problems and conjunctive water resource uses was recommended. (EPA) W73-11441

ADSORPTION OF CHLORINATED HYDROCARBONS FROM SEAWATER BY A CROSSLINKED POLYMER,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05A.
W73-11443

OIL/SORBENT HARVESTING SYSTEM FOR USE ON VESSELS OF OPPORTUNITY,
URS Research Co., San Mateo, Calif.
J. D. Sartor, C. R. Foget, and R. W. Castle.
Copy available from GPO Sup Doc as EP1.23/2:73-166, \$1.25; microfiche from NTIS as PB-221 550, \$0.95. Environmental Protection Agency, Technology Series Report EPA-R2-73-166, April 1973. 99 p, 66 fig, 19 tab, 7 ref. EPA Project 15080 HER. 68-01-0069.

Descriptors: *Oil pollution, Oil spills, *Conveyor systems, *Pollution abatement, Water pollution control.
Identifiers: *Oil recovery systems, *Oil/sorbent recovery, Sorbents.

A system for harvesting mixtures of oil and sorbent materials, primarily straw, which could be utilized for the recovery of floating oil from water was developed for use on vessels of opportunity. A three-phase test program was conducted to evaluate candidate system components and operating specifications for the oil/sorbent harvesting system. The first phase of the program involved testing individual system components and operating parameters as to their effectiveness in picking up sorbents only. The first phase was conducted under actual conditions in a saltwater slough. The second phase of the test program entailed evaluating those operating characteristics of the harvesting system components selected in the first phase using crude oil and various sorbents in a test tank. The third phase of the test program entailed the installation of the complete system on a vessel of opportunity (an LCM), and demonstration of the ability of the system to operate under actual conditions. The system was evaluated both in the San Francisco Bay and off Coal Oil Point (Santa Barbara) where sorbent materials were dispersed over natural oil slicks. The system utilizes commercially and readily available equipment which, with minor modifications was assembled on-site into

available vessels. The system was very effective in recovering sorbents (straw and polyurethane foam) from the water surface. (EPA) W73-11445

ENERGY VS. ENVIRONMENT,
For primary bibliographic entry see Field 06G.
W73-11500

REHABILITATION OF IRRIGATION SYSTEMS FOR SALINITY CONTROL,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 03F.
W73-11509

SIMULTANEOUS, MULTIPLE-LEVEL RELEASE FROM STRATIFIED RESERVOIRS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
For primary bibliographic entry see Field 08B.
W73-11567

REMOVAL OF OIL FROM WATER SURFACES BY SORPTION ON UNSTRUCTURED FIBERS,
Texas Tech Univ., Lubbock. Textile Research Center.
R. F. Johnson, T. G. Manjrekar, and J. E. Halligan. Environmental Science and Technology, Vol 7, No 5, p 439-443, May 1973. 9 fig, 3 tab, 17 ref.

Descriptors: *Sorption, *Oil spills, *Sea water, *Methodology, Oil pollution, Fibers (Plant), Physical properties, Pollutants, Water pollution, Cotton, Cellulose, Specific gravity, Temperature, Surface tension, Viscosity, Water pollution control.

Identifiers: *Oil removal, *Crude oil, *Unstructured fibers, Synthetic fibers, Natural fibers, Cleanup, Chemical composition, Water surfaces, Oil characterization, Bunker C oil, Wool, Polypropylene fibers, Acrylic fibers, Nylon 6 fibers, Polyester fibers, Cellulose triacetate, Celulose acetate, Viscose rayon, Polycrylonitrile, Polyhexamethylene adipamide, Polyethylene terephthalate, ENCO No. 6 fuel oil, Clearfork Field crude oil, Friendswood Field crude oil.

The capacity of unstructured fibers to remove crude oil from seawater was related to the chemical composition and surface properties of the fibers as well as the concentration, specific gravity, and temperature of the crude oil. The sorption capabilities of cotton exceeded those observed for all of the other synthetic and natural fibers tested. The amount of oil sorbed increased as the denier of the fiber decreased for all of the materials tested. For the data available, the critical surface tension of the solid sorbent was also related to the amount of oil sorbed. Cyclic sorption/desorption studies indicated that a simple squeezing operation was sufficient to remove most of the oil sorbed on the fibers and that recycling was feasible. (Holoman-Battelle) W73-11586

PLANKTONIC CHANGES FOLLOWING THE RESTORATION OF LAKE TRUMEN, SWEDEN,
Lund Univ. (Sweden). Limnology Inst. G. Andersson, G. Cronberg, and C. Gelin. AMBIO, Vol 2, Nos 1/2, p 44-47, February 1973. 7 fig, 9 ref.

Descriptors: *Nutrients, *Primary productivity, *Phytoplankton, *Zooplankton, *Hydrogen ion concentration, Trophic level, Dredging, Succession, Eutrophication, Sediments, Sampling, Phosphates, Phosphorus, Ammonia, Nitrogen, Biomass, Diatoms, Water analysis, Rotifers, Pyrophyta, Anabaena, Invertebrates, Chlorophyta, Crustaceans.

Identifiers: *Restoration, *Transparency, Melosira, Aphanizomenon flos-aquae, Micro-

cystis aeruginosa, Dinobryon, Synura, Mallomonas, Glenodinium, Oscillatoria, Anabaena flos-aquae, Anuraceopsis fissa, Filinia longisetata, Trichocerca pusilla, Chydorus sphaericus, Bosmina longirostris, Polyarthra, Brachionus angularis, Keratella quadrata, Cladocera, Macrocyclops.

Restoration of Lake Trummen, a shallow oligotrophic lake near Vaxjo, Sweden, was attempted by first cutting off pollutant sources and then removing the nutrient-rich sediment by suction-dredging. Some of the changes are reported in the plankton communities in 1969 (before restoration) and 1972 (the year after restoration). Water samples were analyzed for phosphates, total phosphorus, ammonia, Kjeldahl nitrogen, pH, and transparency. Phytoplankton samples were collected at least once a month with a Ruttner sampler. Primary productivity of phytoplankton was determined by C-14 uptake. Zooplankton samples were collected in a plexiglass tube from 20 sites over 1-2 week intervals and composited for counts. Comparison of data showed that transparency increased and pH normalized after the restoration. Other primary changes occurred as follows. Biomass of phytoplankton was reduced; the massive bloom of *Microcystis aeruginosa* disappeared; Maxima of diatoms occurred during August rather than in Spring and autumn; *Chrysophyceae* and *Glenodinium* developed under ice; nanoplankton increased; and productivity, although not greatly different, resulted in larger part from nanoplankton. The most striking change in zooplankton was that species indicative of eutrophy (*Brachionus angularis*, *Trichocerca pusilla*, *Keratella quadrata*, *Chydorus sphaericus*) declined dramatically. (Little-Battelle) W73-11639

MSB COMPUTERIZED COMBINED SEWER CONTROL SYSTEM,
Metropolitan Sewer Board St. Paul, Minn. M. L. Robins.

Presented at the International Public Works Congress and Equipment Show, Annual Meeting Minneapolis, September 26, 1972. 14 p.

Descriptors: *Sewers, *Overflow, *Water pollution control, *Computer models, *Combined sewers, Minnesota, Storm runoff, Water pollution sources, Water quality control, Computer programs, Regulated flow.

Identifiers: *Combined sewer interceptors, *Minneapolis-St. Paul.

The Minneapolis-St. Paul Sanitary District assumed responsibility for all sewer overflow regulators in the area in 1965 because of the need to control combined sewer overflows in the Twin Cities. Based upon a program planned between 1956 and 1960, these regulators were studied to obtain their maximum pollution abatement utilization. The realization that rainfall patterns over the metropolitan area are seldom uniform led to the idea of controlling the regulators individually to achieve maximum storm water overflow reductions. The system was developed under a Federal Water Pollution Control Administration grant of over \$850,000. Three major projects developed in 1967-1968 were: (1) basic regulator modification including hydraulically-operated gates and air-inflated fabric dams (Fabridams); (2) installation of vaults to house the equipment and controls for in-sewer instrumentation; and (3) a computer-based control system. Normally the Fabridams are fully inflated, diverting all water to the sewage treatment plant. But during a storm, a system of rainfall gauges placed around the Twin Cities, along with measurement of in-sewer flow and river water quality, sends pertinent data to the computer. The computer can then predict sewer surcharging, excessive pressure on the Fabridams, and resultant river pollution under various options of deflating some of the Fabridams. The latter would allow combined sewer overflow to be dumped into the

WATER RESOURCES PLANNING—Field 06

Techniques of Planning—Group 6A

Mississippi River. By using Fabridams and deflating only those which had to be deflated, the overflows to the River had been reduced in duration by about 85 percent in 1969 and about 85 percent in both 1970 and 1971. (Poertner)
W73-11673

THE NEED FOR HYDROGEOLOGIC EVALUATIONS IN A MINE DRAINAGE ABATEMENT PROGRAM: A CASE STUDY, TOMS RUN, CLARION COUNTY, PENNSYLVANIA, Pennsylvania Dept. of Health, Harrisburg, Bureau of Sanitary Engineering.

G. L. Merritt, and G. H. Emrich.

Mellon Institute, Third Symposium on Coal Mine Drainage Research, Pittsburgh, May 19-20, 1970. p 334-364, 14 fig, 10 tab, 11 ref.

Descriptors: *Water pollution control, *Mine drainage, *Hydrogeology, *Acid mine water, Pennsylvania coal mine wastes, Industrial wastes, Water pollution sources, Data collections, Evaluation, Assessments, Water pollution control.

Identifiers: *Toms Run, *Hydrogeologic evaluations.

In the Toms Run drainage basin in Pennsylvania, the development of oil, gas, and coal resources has created many water pollution problems, through the changing of the hydrogeologic properties within the aquifers. The quality of groundwater in the Toms Run is affected by mine drainage and varies depending on the proximity of the drainage basin to the mining. The secondary iron deposits in the Toms Run basin, although long thought to be from oil and gas well brines, are also found to be from the coal mine drainage moving through the aquifers. The major pollution of the Toms Run is from the coal mining operations. The oil and gas wells act as conduits to move the acid mine drainage from the surface to underlying aquifers. Thus, to solve the problems of the Toms Run, it is necessary to back-fill and restore coal strip mines both inside and outside the drainage basins and to clean up the acid iron-rich springs present in the area. Geology and hydrogeology are discussed in detail, because an accurate knowledge of these factors is important to understanding of the problem. (Poertner)

W73-11674

HYDROGEOLOGIC CONSIDERATIONS FOR SEALING COAL MINES, Pennsylvania Dept. of Health, Harrisburg, Bureau of Sanitary Engineering.

D. R. Thompson, and G. H. Emrich.

Publication Number 23, August, 1969. 21 p, 11 fig, 6 ref.

Descriptors: *Mine drainage, *Soil sealants, *Coal mine wastes, *Seepage control, *Sealants, *Hydrogeology, Acid mine water, Water pollution control, Pennsylvania, Water pollution sources, Mining, Mining engineering, Mine acids.

Identifiers: Air sealing, Water-tight sealing.

Coal mine pollution is the major source of water pollution in Pennsylvania. More than 2,000 miles of rivers in the state are adversely affected by coal mine drainage. A solution to stopping coal mine drainage could drastically improve Pennsylvania water quality. Two basic types of mine sealing exist—water-tight sealing and air sealing. The basic principle of air sealing is to prevent oxygen from entering the mine to prevent oxidation of pyrites and the formation of sulphuric acid. Accomplished by several methods, but basically by covering the mine shaft with earth, the use of air seals in past years has not been effective in preventing pollution and water-tight seals are now necessary. In this method, the mine shaft portal is blocked by an impervious material such as concrete to allow the mine to fill with natural groundwater and to exclude groundwater seepage from the mine. However, geological considerations must still be taken

into consideration, especially groundwater flow, direction and pressure. The water-tight seal must be of sufficient strength to resist the groundwater pressure, must be supported on all sides by rock of sufficient strength, and must be placed in a position to actually keep the groundwater from leaving the mine. By conducting mining operations with future planning for seals, water-tight seals should provide adequate protection to half much of the coal mine drainage pollution problem. Double-wall seals are suggested for added protection. (Poertner)
W73-11675

LEACHATE QUALITY FROM ACIDIC MINE SPOIL FERTILIZED WITH LIQUID DIGESTED SEWAGE SLUDGE, Metropolitan Sanitary District of Greater Chicago, Ill.

J. R. Peterson, and J. Gachwind.

Presented before Div. A-5, American Society of Agronomy, New York, August 17, 1971. 16 p, 2 tab, 2 fig, 10 ref.

Descriptors: *Coal mine wastes, *Mine drainage, *Sludge disposal, Neutralization, Water pollution control, Fertilization, Leaching, Laboratory tests, Illinois.

Identifiers: Chicago.

The spoils from coal strip-mining sometimes contain sulfide minerals which, when oxidized, produce substantial quantities of sulfuric acid. These acids are harmful in themselves but also increase the solubility of the metals contained in the strip mined spoil. These metals are often toxic to plant growth and as a result, strip mined spoils are often barren of vegetation. The Metropolitan Sanitary District of Greater Chicago is seeking solutions to this problem and, in this paper, presents the results of one attempted solution, the application of digested sewage sludge. Four plexiglass columns were filled with mine spoilage and varying quantities and mixtures of sludge. After saturating the columns initially, and then adding constant volumes of aerated deionized water each day, the resultant leachate was collected from the four columns and analyzed for pH, phosphorus, nitrogen, sulfates, total acidity, electrical conductivity and twelve metals. The digested sludge when used in a proportion of 1:37 by weight, with mine spoilage, changed the pH from 2.5 to 4.6 and reduced aluminum by 99 percent, iron by 80 percent, and soluble salts by 41 percent. On the other hand, SO₄ increased by 49 percent Mg by 827 percent, NH₃-N by 1689 percent and Zn by 1941 percent. The leaching test ran for 110 days, and the use of a sludge-spoil mixture underlain by a spoil layer produced almost no change in leachate quality from the pure spoil column. The addition of sludge increased infiltration, and reduced runoff from mine spoil wastes. (Poertner)

W73-11680

SUPPLEMENTATION OF MISSING VALUES IN WATER QUALITY DATA, Kansas State Univ., Manhattan. Dept. of Chemical Engineering.

K. P. R. Krishnan, L. T. Fan, and L. E. Erickson. Water Resources Bulletin, Vol 9, No 3, p 455-466, June, 1973. 3 fig, 4 tab, 11 equ, 7 ref.

Descriptors: *Water quality control, *Data collections, *Ohio River, *Statistical methods, *Dissolved oxygen, Equations, Evaluation, Methodology, Water temperature.

Identifiers: *Linear interpolation, *Harmonic analysis, Sample variance, Missing data estimation.

In the analysis of continuous records of water quality data from automatic monitors, periods of missing values through failure to record, gross errors in recording, or accidents are frequently encountered. The problem of estimating missing

values in water quality data using linear interpolation and harmonic analysis is studied to see which one of these two methods yields better estimates for the missing values. The data used in this study consists of midnight values of dissolved oxygen from the Ohio River collected over a period of one year at Stratton station. The results indicate that records with less than ten percent of missed data could be supplemented using either of the two methods; linear interpolation is suggested since it is easier to apply. When the percentage of missed data points exceeded ten percent of the total number in the original sample, harmonic analysis usually yielded better estimates for both the regularly and irregularly missed cases. For data that exhibit cyclic variation, examples of which are dissolved oxygen concentration and water temperature, harmonic analysis as a data generation technique appears to be superior to linear interpolation. At percentages higher than fifty, the missing data can be estimated; however, these situations are rarely encountered and statistical tests indicate that in such situations neither of the two methods yields reasonable estimates. (Bell-Cornell)
W73-11687

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

TOWARD A PHILOSOPHY OF PLANNING: ATTITUDES OF FEDERAL WATER PLANNERS, Stanford Univ., Calif. Dept. of Civil Engineering. R. H. Wilson.

Copy available from GPO Sup Doc as EP1.23/3-73-015, \$2.60; microfiche from NTIS as PB-221 433, \$0.95. NTIS PC5.10. Environmental Protection Agency, Socioeconomic Environmental Studies Series Report, EPA-R5-73-015, March 1973, 224 p, 30 tab, 55 ref. EPA Project 1610 DWX.

Descriptors: *Planning, *Attitudes, *Federal government, Administrative agencies, *Federal policy, *Decision making, Water policy, Management, Employee relations.

Interviews were conducted with 70 planners from federal water resources agencies to determine their attitudes toward planning objectives, their personal role in planning, the social-political structure, time, and the environment. Responses of the planners are summarized and compared with views of others on the proper role of the planner in the planning process. Some conclusions as to methods in improving the planning process are presented. (Linsley-Stanford)
W73-11673

ITERATIVE SIMULATION ALGORITHM IN RESERVOIR SYSTEMS OPERATION, Purdue Univ., Lafayette, Ind. Water Resources Research Center.

For primary bibliographic entry see Field 04A.

W73-11139

DISAGGREGATION PROCESSES IN STOCHASTIC HYDROLOGY, Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

For primary bibliographic entry see Field 02E.

W73-11141

BEHAVIOR OF GROUNDWATER FLOW SUBJECT TO TIME-VARYING RECHARGE, Water Resources Engineers, Inc., Springfield, Va. For primary bibliographic entry see Field 02F.

W73-11142

Field 06—WATER RESOURCES PLANNING

Group 6A—Techniques of Planning

PEAK LOAD PRICING MODEL OF AN ELECTRIC UTILITY USING PUMPED STORAGE,
Boston Univ., Mass. Dept. of Economics.
R. Jackson.
Water Resources Research, Vol 9, No 3, p 556-562, June 1973. 4 fig, 11 ref.

Descriptors: *Electric power, *Water resources, *Peak loads, *Pricing, *Pumped storage, *Optimization, Evaluation, Powerplants, Operating costs, Mathematical models, Systems analysis.
Identifiers: *Equilibrium welfare economics, Welfare maximization.

Electric utilities are increasing their use of water power to supplement system capacity during peak demand intervals. During off-peak periods, electricity derived from fuel generators is used to store water, and when the peak period arrives, the demand is satisfied by production from both fuel and hydroelectric generators. This pumped storage technique is particularly well-suited to nuclear plants that cannot be "turned off" during low demand intervals. Presented is a peak load pricing model, based on partial equilibrium welfare criteria, for determining the optimal prices in the peak and off-peak periods and the amount of electric power that should be used during the off-peak intervals to pump water. Current peak load models have always assumed that the consumption and the production of electricity are instantaneous and have not considered the storage possibility by using water resources. A pricing rule for welfare maximization emphasizing capacity charges is first derived, and then a graphical model is developed that can be adapted to the installation of a particular utility. A method of evaluating plant expansion programs by using the model is also indicated, the benefits from increased consumption and lower operating costs being compared to the additional capacity cost. (Bell-Cornell)
W73-11146

PROGRESSIVE TAXATION AS A POLICY FOR WATER QUALITY MANAGEMENT,
California Univ., Riverside. Dept. of Economics.
For primary bibliographic entry see Field 05G.
W73-11147

PROGRAMMING MODEL FOR EVALUATING ECONOMIC AND FINANCIAL FEASIBILITY OF IRRIGATION PROJECTS WITH EXTENDED DEVELOPMENT PERIODS,
California Univ., Davis. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W73-11149

AN ENVIRONMENTAL EVALUATION SYSTEM FOR WATER RESOURCE PLANNING,
 Battelle Columbus Labs., Ohio.
N. Dee, J. Baker, N. Drobny, K. Duke, and I. Whilman.
Water Resources Research, Vol 9, No 3, p 523-535, June, 1973. 15 fig, 2 tab, 10 ref.

Descriptors: Water resources development, Projects, *Planning, *Environment, *Evaluation, *Methodology, Multiple-purpose projects, Estimating, Systems analysis, Pollution, Social aspects.
Identifiers: *Environmental impact analysis, Environmental quality.

The Environmental Evaluation System (EES) is a methodology for conducting environmental impact analysis. Developed by an interdisciplinary research team, it is based on a hierarchical arrangement of environmental quality indicators that classifies the major areas of environmental concern into major categories, components, and ultimately into parameters and measurements of environmental quality. The EES provides for environmental impact evaluation in four major categories: Ecology, environmental pollution,

esthetics, and human interests. These four categories are further broken down into 18 components and finally into 78 parameters. The method provides a means for measuring or estimating selected environmental impacts of large-scale water resource development projects in commensurate units termed "environmental impact units" (EIU). Results of using EES include a total score in EIU with and without the proposed project; the difference between the two scores is one measure of environmental impact. Environmental impact scores developed in the EES are based on the magnitude of specific environmental impacts and their relative importance. Another major output from EES is an indication of major adverse impacts called "red flags", which are of concern of and by themselves. These flags indicate fragile elements of the environment, which must be studied in more detail. (Bell-Cornell)
W73-11151

STOCHASTIC RESERVOIR MANAGEMENT AND SYSTEM DESIGN FOR IRRIGATION,
New South Wales Univ., Kensington (Australia).
School of Economics.

For primary bibliographic entry see Field 03F.
W73-11152

QUALITATIVE VALUES IN ENVIRONMENTAL PLANNING: A STUDY OF RESOURCE USE IN URBANIZING WATERSHEDS,
Harvard Univ., Cambridge, Mass., Dept. of Landscape Architecture.

For primary bibliographic entry see Field 05G.
W73-11153

THE ESTIMATION OF THE HYDROLOGICAL IMPACT OF URBANIZATION: AN EXAMPLE OF THE USE OF DIGITAL SIMULATION IN HYDROLOGY,
University Coll., London (England).

For primary bibliographic entry see Field 04C.
W73-11159

NONLINEAR PARAMETER ESTIMATION IN WATER QUALITY MODELING,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.

For primary bibliographic entry see Field 05B.
W73-111361

DISCRETE GRADIENT OPTIMIZATION OF WATER SYSTEMS,
Medical Univ. of South Carolina, Charleston. Dept. of Biometry.

For primary bibliographic entry see Field 08B.
W73-111365

A DYNAMIC PROGRAMMING APPROACH FOR INVESTMENT STRATEGIES IN WASTE-WATER TREATMENT PLANTS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.

For primary bibliographic entry see Field 05D.
W73-11426

A MATHEMATICAL MODEL TO AID MANAGEMENT OF OUTFLOW FROM THE OKAVANGO SWAMP, BOTSWANA,
University of the Witwatersrand, Johannesburg (South Africa). Hydrological Research Unit.
I. P. G. Hutchison, and D. C. Midgley.
Journal of Hydrology, Vol 19, No 2, p 93-112, June 1973. 11 fig, 8 ref.

Descriptors: *Mathematical models, *Water management (Applied), *Water supply, Streamflow forecasting, Swamps, Africa, Vegetation effects, Geology, Evapotranspiration.
Identifiers: *Okavango River (Botswana).

A series of mathematical models permits a 20-year sequence of flows to be routed through a complex river and swamp system. This allows simulation of the behavior of the Mopipi off-channel storage from which the Orapa Diamond Mine, Botswana, draws its water supply. Although the diversion would have met the design demand throughout the simulation period, the source area is highly sensitive to relatively minor vegetational changes and possibly also to seismic activity. For this reason, coupled with the fact that future developmental pressures are likely to conflict with the desire to preserve this wilderness environment, the scope of the model should be widened to embrace the whole of the Okavango delta. (Knapp-USGS)
W73-111543

LINEAR PROGRAMMING USE FOR EVALUATING WATER RESOURCES AND COST AND BENEFIT ALLOCATION,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.

R. A. Andrews, and R. R. Weyrick.

Water Resources Bulletin, Vol 9, No 2, p 258-272, April, 1973. 4 fig, 7 tab, 5 ref.

Descriptors: *Linear programming, *River basins, *Multiple purpose, *Water resources, *Evaluation, *Cost allocation, *Resource allocation, *New Hampshire, Optimization, Benefits, Surface waters, Water users, Lakes, Recreation, Shores, Industries, Waste water (Pollution), Constraints, Coliforms, Biochemical oxygen demand, Computer programs.

Identifiers: *Ashuelot River (N.H.), Implicit prices, Price sensitivity, Objective functions, River-flow levels, Economic activity.

The results of using linear programming to evaluate water resources and cost and benefit allocation of surface water uses in a small southern New Hampshire river basin are presented. The model includes almost all water-related economic activity both for consumers and producers and can analyze the entire basin or basin sub-division. It includes seven sectors, nine objective function criteria, and three river-flow levels, and contains 132 equations and 218 activities. The activities include water use, production and consumption activities, wastewater treatment, and water transfer activities from one use to another. To recognize the most limiting river water flow and water resource use, the period analyzed is the month of August. The incidence of benefits and costs is shown to shift with objective optimized and river flow level. The disposal of untreated household wastewater, particularly from the rural household, directly into the river is consistent with maximizing net benefits and minimizing costs. The optimum resource allocation, water-treatment plants, farms and industry activities would change with flow level. For each of the three industries analyzed separately—paper, wool and tanning—public treatment of industrial wastewater is the optimal treatment process in one or more of the solutions. Lake shoreline is the dominant feature determining lake-resource valuation. (Bell-Cornell)
W73-114263

ON LARGE DIVERSIONS FROM THE NORTHWEST—NORMAL AND HIGH-FLOW YEARS,
Washington State Univ. Pullman. Dept. of Computer Science.

R. D. Dutton, and C. B. Millham.

Water Resources Bulletin, Vol 9, No 2, p 231-242, April, 1973. 8 tab, 9 ref.

Descriptors: *Columbia River, *Pacific Northwest U.S., *Diversion losses, *Economics, *Dams, Pollution abatement, Assessments, Mathematical models, Systems analysis.

Identifiers: *Snake River, Power generation, Brownlee Dam, McNary Pool.

WATER RESOURCES PLANNING—Field 06

Evaluation Process—Group 6B

This work assesses economic losses due to diversion of Snake and Columbia River waters. It is a sequel to the work of Millman and Russell (1971), which used a 3-dam, 6-time-period model to assess the economic losses accruing to the Pacific Northwest due to diversion in low-flow years of Snake River waters above Brownlee Dam to other geographical regions; its data, derived in 1967, is now out-of-date because of the rapid escalation of nuclear power costs. This effort demonstrates a 7-dam, 12-time-period model capable of handling high flows, and presents power replacement costs, based on current thermal plant construction costs, for the significant dams of the Snake-Columbia basin. The model and data are applied to an assessment of the losses that would accrue to the Pacific Northwest from diversions above Brownlee Dam in low, normal, and high-flow years and also from diversions out of McNary Pool during the same years. The tool used is dynamic programming. Only losses due to lost power generation (1972 cost figures) and pollution abatement capability, projected for the year 1990, are included, but data from fisheries and recreation could be incorporated if it were available. (See also W72-02124) (Bell-Cornell)
W73-11685

EXPERIMENT IN THE USE OF DIGITAL COMPUTERS TO DETERMINE TRAVELTIME ON A TRIBUTARY REACH OF A RIVER (OPYT ISPOL'ZOVANIYA ETSVM PRI OPREDELENII VREMENI DOBEGANIYA NA PRITOCHNOM UCHASTKE REKI).
Ukrainiiskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02E.
W73-11692

USE OF DIGITAL COMPUTERS TO COMPUTE PROPAGATION OF FLOOD WAVES ALONG THE CASCADE OF RESERVOIRS ON THE DNIPEER RIVER (PRIMENIYE ETSVM DLYA RASCHETA RASPROSTRANENIYA VOLN POLOVOYI PO KASKADU GIDROUZLOV NA DNEPRE),
Ukrainiiskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02E.
W73-11693

6B. Evaluation Process

PEAK LOAD PRICING MODEL OF AN ELECTRIC UTILITY USING PUMPED STORAGE,
Boston Univ., Mass. Dept. of Economics.
For primary bibliographic entry see Field 06A.
W73-11146

COST-EFFECTIVENESS METHODOLOGIES FOR DATA ACQUISITION IN WATER QUALITY MANAGEMENT,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05G.
W73-11150

ECOLOGIC-ECONOMIC ANALYSIS FOR REGIONAL DEVELOPMENT. SOME INITIAL EXPLORATIONS WITH PARTICULAR REFERENCE TO RECREATIONAL RESOURCE USE AND ENVIRONMENTAL PLANNING,
W. Isard.
Free Press: New York, N.Y., Collier-Macmillan Ltd.: London, England, 1972. 270 p. Pr. \$11.95. Illus.

Identifiers: Books, *Ecologic-economic analysis, Environmental planning, Explorations, Planning, *Recreational use, Resources, *Regional development.

This book discusses several traditional economic and regional science techniques for regional analysis, giving the reader some idea of how standard techniques may be employed, particularly as they apply to continental shelf resource evaluation. Next, it covers natural resources from an extra-economic standpoint, briefly discussing resource classification and several critical ecologic principles. It then illustrates how these principles and their associated subsystems—the food chain, photosynthesis, and the P cycle—can be put into an input-output, programming format paralleling procedures in economics and regional science. The next section develops an interrelations table to record flows among activities, illustrating how the ecologic and economic systems are interrelated via these flows. Next a case study is presented, considering the general Plymouth-Kingston-Duxbury Bay area. Finally, the book enumerates the possibilities of study for the further development of a methodology for the synthesis of economic and ecologic analyses, as well as discussing the interrelations among resource development, economic growth and comprehensive coastal zoning.—Copyright 1972, Biological Abstracts, Inc.
W73-11176

THE EVOLVING ROLE OF THE FEDERAL GOVERNMENT IN THE MANAGEMENT OF LAKE MICHIGAN,
Michigan Univ., Ann Arbor. School of Natural Resources.
For primary bibliographic entry see Field 06E.
W73-11247

WATER SUPPLY PLAN FOR THE SOUTHEASTERN CONNECTICUT REGION, VOLUME II, RECOMMENDED PLAN.
Southeastern Connecticut Water Authority, Norwich; and the Southeastern Connecticut Regional Planning Agency, Norwich.

February 1970. 100 p, 11 fig, 6 tab, 26 ref. U.P.A. Conn. P-104.

Descriptors: *Planning, *Water supply, Water sources, Water demand, Administration, Groundwater, Costs, Water distribution (Applied), *Connecticut.

Identifiers: Load centers, Service areas.

This is the second phase of the water supply study and plan formulation being carried out jointly by the Southeastern Connecticut Water Authority and the Southeastern Connecticut Regional Planning Agency. The Water Authority was created in 1967 and given broad powers to deal with increasing growth and water demands. It is working closely with the town governments in the region and is using the regional development plan produced by the Regional Planning Agency as a guide. The study looks at all the previous water supply studies for the area, projects water demands using the concept of primary load or demand centers, surveys existing and potential sources of water supply, recommends a water supply plan for the central urban area and seven load centers, and discusses the costs and administration involved. The study emphasizes the joint use of surface water and groundwater so that the surface water can also be used for other purposes such as recreation. Numerous maps and charts are included. (Elfers-North Carolina)
W73-11249

REGIONAL WASTE WATER, SOLID WASTE DISPOSAL, WATER SUPPLY, AND STORM DRAINAGE SYSTEMS APPRAISAL.
Harza Engineering Co., Chicago, Ill.

For primary bibliographic entry see Field 05G.
W73-11252

PUBLIC PARTICIPATION IN URBAN WATER PLANNING,

Fort Lewis Coll., Durango, Colo.
T. C. Ferrara, K. A. Romstad, and W. K. Johnson. Journal of the Urban Planning Division, American Society of Civil Engineers, Vol 97, No UP2, p 179-190, December, 1971. 3 fig, 2 tab, 6 ref, 1 append.

Descriptors: *Planning, Information exchange, Land use, Flood control, Watersheds, Coordination, Decision-making, Groundwater, *Urbanization, *California.

Identifiers: *Public participation, *Public interests, Morrison Creek (Calif), Sacramento County (Calif).

This is an analysis of public participation in the preliminary planning for flood control in the Morrison Creek watershed near Sacramento, California. Public participation in planning is often advocated but seldom satisfactorily achieved. The analysis stresses the importance defining the public and their interests early in the planning process and establishing strong communication links such as workshops and public information meetings. The article contains tables and charts defining the public and private participants, their interests, and an information flow chart. In this particular case, private organizations, conservation organizations, and individuals were able to exert substantial influence on the preliminary alternatives for the watershed. A key element in the planning and public participation process was local government's formulation of a definitive land use policy as a basis for communication and decision-making. Active participation by state and federal agencies was also important. (Elfers-North Carolina)
W73-11257

COMPREHENSIVE WATER SEWER PLAN FOR BALDWIN COUNTY, ALABAMA.
Polyengineering, Mobile, Ala.

For primary bibliographic entry see Field 05D.

W73-11261

COMPREHENSIVE WATER AND SEWER PLAN FOR ESCAMBIA COUNTY, ALABAMA.
Polyengineering, Mobile, Ala.

For primary bibliographic entry see Field 05D.

W73-11262

PUBLIC UTILITIES IN WINNEBAGO COUNTY.
City-County Planning Commission, Rockford, Ill.
For primary bibliographic entry see Field 03D.
W73-11263

RESEARCH AND DEVELOPMENT IN WATER RESOURCES, WATER RESOURCES RESEARCH, ITS ROLE IN THE TOTAL R AND D SPECTRUM,
National Water Commission, Arlington, Va.
J. S. Gladwell.

Available from the National Technical Information Service as PB-210 823, \$6.75 in paper copy, \$0.95 in microfiche. Report NWC-EES-72-050, (Special Study No. 20a), January 1972. 240 p, 7 fig, 19 tab, 67 ref.

Descriptors: *Research and development, *Research priorities, *Planning, *Federal Government, *Management, *Water policy, Costs, Technology, Institutions, Manpower, Training, Universities, Economics, Operations, Water Resources Research Act.

Identifiers: Interdisciplinary research, Basic research, Applied research, Development, Appropriations, Geographic distribution, R and D Funding.

This report reviews, with special emphasis on policy implications, the role of water resources research within the total Federal and non-Federal

Field 06—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

R and D spectrum. Although the actual dollar outlay has increased in water research, both (1) the relative effort with respect to other investments and (2) the actual effort in terms of the real value of the dollar investments have indicated a decreasing emphasis on the water aspects of science. The general condition of Federal research (and water research in particular), however, is healthy. However, no single agency or group can be identified as having the 'lead' in water research. The study points to the Office of Water Resources Research as having the greatest potential for this role, but that it is limited by present administrative arrangements. It recommends a national institute for water resources research responsive to all, yet not under the direction of any single agency. Such an Institute (NIWRR) would use OWRR's concept as a core of responsibilities. It would be a focal point of Federal and non-Federal interests in water resources research. Water research would be emphasized as a planning and management tool. Planning and development of programs require both federal and non-federal participation. (OWRR)
W73-11341

THEORY AND PRACTICE OF PUBLIC PARTICIPATION IN PLANNING, Georgia Inst. of Tech., Atlanta.

G. E. Willeke.

Preprint, American Society of Civil Engineers, Natl Water Resour Eng Meet, Washington, DC, Jan-Feb 1973. 21 p, 6 fig, 5 ref.

Descriptors: *Planning, Water resources, Communication, Sociology, Political aspects, Social impact, Social aspects, *Decision making, Psychological aspects.

Identifiers: Briefing, Public affairs, Workshops, *Public opinion.

Communications, sociology and social psychology, and political science provide the principal theoretical base for public participation programs. Planners more readily accept improved communications than other disciplines as a starting point for public participation program development. Techniques used to involve the public include workshops, forums, familiarization tours, brochures, opinion surveys, pro and con sheets, participation scorecards, briefings, and modified public hearings. Generally, the successes have been impressive and rather easy to obtain. Failures usually have not been permanent and do not necessarily cast doubt on the theoretical base. Primary contributions of communications theory are 2-way communication, multistep flow, and multiple entry into the system. Contributions of sociology and social psychology are the notion that planning is a social process, the concept of perception, and the concepts of trust, legitimacy, and rapport. Political science categorizes the political systems into democratic and elitist structures, orderliness, and conformance with law and principle. (USBR)
W73-11510

ECONOMIC GROWTH AND ENVIRONMENTAL IMPACT: EVALUATING ALTERNATIVES, University of Southern California, Los Angeles. N. M. Kamran.

Socio-Econ Plann Sci, Vol 7, No 1, p 37-53, Feb 1973. 3 fig, 1 tab, 15 ref.

Descriptors: *Planning, Decision making, Political aspects, *Environmental effects, Methodology, Evaluation, *Social aspects, Political constraints, Input-output analysis, Cost-benefit analysis, Economic feasibility, Bibliographies, Environmental engineering, Economic impact.

Identifiers: Environmental evaluation, Heuristic methods, Environmental policy, Environmental quality.

This exploratory policy planning paper aims to bring together societal, environmental, and growth factors into a unified planning method. The growth factor is traditionally emphasized in planning, but environmental and societal considerations are emphasized in this scheme. Cost of negative environmental impacts of economic growth projects should be subtracted from the value of economic growth projects and their impacts on society should be assessed. Principal elements in the systematic framework suggested for developing an economic growth strategy are: (1) identifying major alternatives, which involves considering public and private policies; (2) evaluating the chosen alternatives based on economic and environmental considerations; and (3) setting priorities and selecting alternatives based on policy-effectiveness and cost-benefits. This methodology is useful in structuring and summarizing an enormous amount of information and applying collective judgments on a large number of National goals (USBR).
W73-11511

CONSTRUCTION DIFFICULTY INDEX FOR TUNNEL CONSTRUCTION,

Metropolitan Sanitary District of Greater Chicago, Ill.

For primary bibliographic entry see Field 08H.

W73-11681

LINEAR PROGRAMMING USE FOR EVALUATING WATER RESOURCES AND COST AND BENEFIT ALLOCATION,

New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.

For primary bibliographic entry see Field 06A.

W73-11683

AESTHETIC PREFERENCE FOR WATER RESOURCE PROJECTS: AN APPLICATION OF Q METHODOLOGY,

Massachusetts Univ., Amherst. Dept. of Agricultural and Food Economics.

S. E. Gauger, and J. B. Wyckoff.

Water Resources Bulletin, Vol 9, No 3, p 522-528, June, 1973. 7 p, 7 ref.

Descriptors: *Aesthetics, *Preferences (Water rights), *Water resources, *Projects, *Intangible benefits, *Measurement, Planning, Photography, Natural resources.

Identifiers: Factor analysis, Q methodology.

Many resources which generate aesthetic and visual benefits are publicly owned and their optimum use and development depends upon public investment. Traditionally, public investment decisions have been couched in economic terms requiring quantitative measurement of benefits and costs. Many of the benefits these resources provide are not consumed when they are enjoyed; thus, if the total contribution of the resource is measured in the conventional market sense, less than socially optimal investment may occur. Presented is a study designed to investigate whether aesthetic preferences related to water projects can be determined, and whether they differ among different groups of people. A Q sort of 44 photographs of a wide variety of water development projects was conducted with two groups: Photographers (aesthetic man) and town assessors (economic man). In the resultant analysis, aesthetic preferences were consistent between the two groups tested. The test revealed that people do not necessarily equate only naturalness with aesthetic appeal, but will accept development as aesthetic, provided that it is designed to complement the natural landscape. (Bell-Cornell)
W73-11684

ON LARGE DIVERSIONS FROM THE NORTHWEST—NORMAL AND HIGH-FLOW YEARS,
Washington State Univ, Pullman. Dept. of Computer Science.
For primary bibliographic entry see Field 06A.
W73-11685

FORMATION AND FORECAST OF COMPONENTS IN THE HYDROLOGIC REGIMEN OF RIVERS (FORMIROVANIYE I PROGNOZ ELEMENTOV GIDROLOGICHESKOGO REZHIMA REKI),
Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02E.
W73-11688

PREDRECOMPUTATION OF A SPRING-FLOOD HYDROGRAPH BASED ON HYDROMETEOROLOGICAL DATA (PREDVYCHISLENIYE GIDROGRAFA VESENNEGO POLOVOD'YA PO GIDROMETEOROLOGICHESKIM DANNYM),
Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02E.
W73-11689

FORECASTING QUARTERLY INFLOW OF WATER TO DNEPER RIVER RESERVOIRS DURING THE COLD HALF OF THE YEAR (O PROGNOZIROVANII KVARTAL'NOGO PRITOKA VODY V DNEPROVSKIE VODOKHRANILISHCHA ZA KHOLODNUYU POLOVINU GODA),
Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02H.
W73-11691

FORECASTING TIME OF FORMATION OF COMPLETE ICE COVER IN THE UPPER DNEPER BASIN (O PROGNOZIROVANII SROKOV NASTUPLENIYA LEDOSTAVA V BASSEYNE VERKHNEGO DNEPRA),
Ukrainskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Kiev (USSR).
For primary bibliographic entry see Field 02C.
W73-11695

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE NORTHERN MAINE REGIONAL TREATMENT SYSTEM,
Northern Maine Regional Planning Commission, Presque Isle.
For primary bibliographic entry see Field 05D.
W73-11079

PROGRESSIVE TAXATION AS A POLICY FOR WATER QUALITY MANAGEMENT,
California Univ., Riverside. Dept. of Economics.
For primary bibliographic entry see Field 05G.
W73-11147

URBANIZATION'S DRAINAGE CONSEQUENCE,
Nolte (George S.) and Associates, San Jose, Calif.; and San Diego County Comprehensive Planning Organization, Calif.
For primary bibliographic entry see Field 04C.
W73-11254

COMMUNITY IMPROVEMENTS AND SERVICE COSTS,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 03D.

WATER RESOURCES PLANNING—Field 06

Water Law and Institutions—Group 6E

W73-11255

LEAST COST METHOD FOR SEWER DESIGN,
Camp, Dresser and McKee, Boston, Mass.
For primary bibliographic entry see Field 05G.
W73-11360

MULTILEVEL CONTROL OF MULTIPOLLUTANT SYSTEM,
Case Western Reserve Univ., Cleveland, Ohio.
Systems Research Center.
For primary bibliographic entry see Field 05G.
W73-11363

A DYNAMIC PROGRAMMING APPROACH FOR INVESTMENT STRATEGIES IN WASTE-WATER TREATMENT PLANTS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W73-11426

TOTAL MERCURY AND METHYLMERCURY CONTENT OF THE AMERICAN EEL (ANGUILLA ROSTRATA),
Fisheries Research Board of Canada, Halifax (Nova Scotia). Halifax Lab.
H. C. Freeman, and D. A. Horne.
Journal of the Fisheries Research Board of Canada, Vol 30, No 3, p 454-456, March 1973. 1 tab, 8 ref.

Descriptors: *Mercury, *Pollutant identification, *Chemical analysis, Marine fish, Eels, Heavy metals, Saline water fish, Canada.
Identifiers: *Methylmercury, *Anguilla rostrata, *Muscle, American eel, Animal tissues, Semimicro gas liquid, Chromatography, Flameless atomic absorption spectrophotometry, Organometallics, Medway River, Organomercury compounds.

Two groups of American eels (*Anguilla rostrata*) obtained from the Medway River in Nova Scotia were analyzed for the presence of mercury. Homogenates were prepared from about 50 percent of the dorsal muscle using a blender; portions of the same homogenate were used for both total mercury and methylmercury determinations. Total Hg and methylmercury were determined in duplicate on each homogenate by the semiautomated flameless atomic absorption method of Armstrong and Uthe (1971) and the semimicro gas-liquid chromatography method of Uthe et al (1972), respectively. The total mercury content was 0.72 plus or minus 0.05 ppm and the methylmercury content was 0.40 plus or minus 0.06 ppm (mean plus or minus SE for 23 fish). Since the mean total mercury content was less than 1 ppm and the toxic methylmercury content was 50 percent of this, or less than the 0.5 ppm guideline, such eels may be acceptable for human consumption. (Holman-Battelle)
W73-11576

FINANCING PRIVATE WATER RESOURCE DEVELOPMENT: ANALYSIS OF A STATE LOAN PROGRAM,
Wyoming Univ., Laramie. Div. of Agricultural Economics.
For primary bibliographic entry see Field 03F.
W73-11686

6D. Water Demand

NORTH ATLANTIC REGIONAL WATER RESOURCES STUDY : APPENDIX H, MINERALS,
Bureau of Mines, Washington, D.C.
For primary bibliographic entry see Field 03D.
W73-11107

SCOPE OF PUBLIC WATER SUPPLY NEEDS.
New York State Temporary Commission on the Water Supply Needs of Southeastern New York, Albany.

November 1, 1972. 149 p, 10 fig, 48 tab, 26 ref, 4 append.

Descriptors: *Water supply, *Water demands, *Future planning, Projections, Forecasting, Safe yield, Management, Water resources development, *New York.
Identifiers: Southeastern New York.

This study of the future water supply needs of the southeastern New York area focuses on the years 2000 and 2020 and concludes that projected population increases and greater commercial and industrial demands for water will create water supply deficits in the neighborhood of 800 mdg. These deficits can be met by reducing demands via conservation programs, by new technological developments such as groundwater recharge, and by developing new sources of water. The report is divided into five basic parts: (1) population analysis and projections; (2) inventory of water systems existing in southeastern New York; (3) forecasts of public water supply needs, particularly industrial; (4) analysis of the safe yield of the existing water supply systems and sources, e.g. the reservoirs in the headwaters of the Delaware River basin and the wells on Long Island; and (5) estimates of future deficits in water supply without new development and improved management. Detailed appendices on the above forecasts and inventories are included. (Elfers - North Carolina)
W73-11245

WATER SUPPLY PLAN FOR THE SOUTHEASTERN CONNECTICUT REGION, VOLUME II, RECOMMENDED PLAN,
Southeastern Connecticut Water Authority, Norwich; and the Southeastern Connecticut Regional Planning Agency, Norwich.
For primary bibliographic entry see Field 06B.
W73-11249

COMPREHENSIVE REGIONAL WATER AND SEWER INVENTORY AND ANALYSIS,
Alabama-Tombigbee Rivers Regional Planning and Development Commission, Camden.
For primary bibliographic entry see Field 07B.
W73-11670

ON LARGE DIVERSIONS FROM THE NORTHWEST-NORMAL AND HIGH-FLOW YEARS,
Washington State Univ. Pullman. Dept. of Computer Science.
For primary bibliographic entry see Field 06A.
W73-11685

6E. Water Law and Institutions

AN ECONOMIC ANALYSIS OF FLOOD DAMAGE REDUCTION ALTERNATIVES IN THE MINNESOTA RIVER BASIN,
Minnesota Univ., St. Paul. Dept. of Agricultural and Applied Economics.
For primary bibliographic entry see Field 06F.
W73-11055

PROTECTION AND CONTROL OF THE SALT WATER SHORE AREA.
Rhode Island Statewide Planning Program, Providence.

Available from NTIS Springfield, Va. 22151 as PB-212 886, Price \$3.00 printed copy; \$0.95 microfiche. Technical Paper No 21, May 1972. 39 p, 10 fig, 8 ref, 1 append. RI-01-06-1003.

Descriptors: *Shore protection, *Coasts, *Rhode Island, *Erosion control, Methodology, Legal aspects, State governments, Littoral drift, Waves (Water), Ocean waves, Storms, Public lands, Reviews, Planning.
Identifiers: Private property regulations.

A possible approach is explored for the protection and regulation of Rhode Island's immediate salt-water shoreline. The report points out the critical nature of this area, discusses public and private interests in the shore area, describes past efforts to delineate a 'critical area' along the shore, and offers recommendations for protection and regulation. The designation of critical areas by a state for purposes of controlling the use and development of land is gaining wider acceptance. In Rhode Island, legislation has been enacted authorizing the application of special controls to historic districts, and in some cases to individual structures of historic value. At the federal level, the national land-use policy bills being considered by Congress recognize this technique as one means of expressing and implementing land-use policies. The appendix contains suggested legislation of two types: one to improve protection of coastal wetlands and one to regulate the entire immediate shoreline area. (Woodard-USGS)
W73-11114

THE EVOLVING ROLE OF THE FEDERAL GOVERNMENT IN THE MANAGEMENT OF LAKE MICHIGAN,
Michigan Univ., Ann Arbor. School of Natural Resources.

W. L. Jackson.

Available from the National Technical Information Service as COM-72-11436. Sea Grant Technical Report No 24, May 1972. 129 p, 7 fig, 43 ref, 4 append. MICHU-SG-72-209.

Descriptors: *Water management, *Comprehensive planning, *Legislation, *Federal government, Institutions, Coordination, Governments, Water policy, *Lake Michigan, *Interstate commissions.

Lake Michigan is a very valuable water resource and provides benefits for such uses as water supply, fishing, waste disposal, recreation, wildlife habitat, and shoreline aesthetics. However, as demands for these uses increase, various conflicts among them become quite critical. Management of these uses has been very fragmented and single-purpose oriented. There is now a great need for comprehensive and coordinated planning and management of the Lake and its uses. A key element in such planning and management could be the federal government via strong enforcement of existing legislation, particularly in relation to water quality, and leadership in coordination among federal, state, and local agencies. Emphasis in the report is on tracing federal activity in water resource management, in general, and relating this to the case of Lake Michigan, including the Lake Michigan Enforcement Conference and the Great Lakes Basin Commission. (Elfers - North Carolina)
W73-11247

RESEARCH AND DEVELOPMENT IN WATER RESOURCES, WATER RESOURCES RESEARCH, ITS ROLE IN THE TOTAL R AND D SPECTRUM,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 06B.
W73-11341

HYDROLOGY AND WATER RESOURCES DEVELOPMENT IN NEPAL,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04A.
W73-11401

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

REPORT OF THE UNITED STATES DELEGATION VISIT TO THE SOVIET UNION: JULY 24 TO AUGUST 6, 1972,
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 08C.
W73-11508

6F. Nonstructural Alternatives

AN ECONOMIC ANALYSIS OF FLOOD DAMAGE REDUCTION ALTERNATIVES IN THE MINNESOTA RIVER BASIN,

Minnesota Univ., St. Paul, Dept. of Agricultural and Applied Economics.

A. R. Hopeman, Jr.

Available from the National Technical Information Service as PB-221 331, \$6.50 in paper copy, \$0.95 in microfiche. Minnesota Water Resources Research Center, Bulletin 58, May 1973. M.S. Thesis, 77 p, 1 fig, 16 tab, 80 ref. OWRR B-054-MINN (1). 14-31-0001-3601.

Descriptors: *Flood Plains, Management, *Non-structural alternatives, *Minnesota, *Land-use, Flood data, Discount rates, *Flood protection, Flood plain insurance, *Cost analysis.

Identifiers: Indemnification programs, Casualty loss provisions, Beneficiaries, *Minnesota River basin.

Incidence of flood costs analysis provides justification for the imposition of land-use restrictions in flood plains in Minnesota. The analysis indicates that governmental units were the ultimate bearers of nearly half the flood costs in the Minnesota River Basin in the 1965 and 1969 floods. Government units have a substantial, justifiable interest in keeping flood costs down. Flood damage potential will continue to rise over time unless land use controls are instituted. Moreover, government costs are likely to make up an even larger proportion of flood costs in the future, with the advent of Federal flood insurance and an expanded Federal role in the provision of disaster relief. Therefore, thorough and vigorous enforcement of the 1969 Flood Plain Management Act is recommended. Whenever thorough economic analyses show them to be feasible, the alternatives of permanent evacuation or construction of local protection works ought to be considered these two alternatives are probably feasible in some areas. In areas where neither evacuation nor structural protection is economically feasible, land-use restrictions alone will have to suffice to curtail flood losses. The beneficiaries of structural flood control works ought to be assessed for a fair share of the costs of such works. This policy is not so crucial for existing flood plain developments, but is important for areas where new developments are permitted. (Walton-Minnesota)
W73-11055

REGIONAL WASTE WATER, SOLID WASTE DISPOSAL, WATER SUPPLY, AND STORM DRAINAGE SYSTEMS APPRAISAL.
Harza Engineering Co., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W73-11252

TOWING ICEBERGS TO IRRIGATE ARID LANDS—MANNA OR MADNESS,
Cold Region Research and Engineering Lab., Hanover, N.H.
W. F. Weeks, and W. J. Campbell.
Science and Public Affairs, Bulletin of the Atomic Scientists, Vol 29, No. 5, p 35-39, May 1973. 4 fig, 15 ref.

Descriptors: *Icebergs, *Water resources development, *Water transfer, *Water supply, Melt water, Water importing, Ice, Oceans, Ships, Methodology, Antarctic, Arctic.
Identifiers: *Iceberg towing.

Eighty-five percent of the world's available fresh-water resides as ice in the Antarctic and Greenland. This water has generally been considered unavailable to portions of the world where large amounts of water could conceivably be utilized. Recent ideas for supplying large amounts of water in the form of ice to arid coastal areas in the Southern Hemisphere via the towing of icebergs are discussed. It is suggested that the idea appears both technologically feasible and economically attractive and merits serious consideration. (Woodard-USGS)
W73-11566

6G. Ecologic Impact of Water Development

ENVIRONMENTAL CONSERVATION,

R. F. Dasmann.

John Wiley and Sons, Inc.: New York, N.Y., London, England. 1972. 3rd Edition. 473 p, Illus, Maps. Pr \$10.50.

Identifiers: Agriculture, Books, *Conservation, *Environmental studies, Foods, Livestock, Minerals, Soils, Wildlife.

This book is intended to provide a text for a 1-semester course concerned with man and his environment. Although a global view of conservation is presented, emphasis is on conservation problems of North America. The content begins with a discussion of the nature of the environment, the major biotic regions and man's record on the earth. Included are chapters on the conservation of the environment, soil, agriculture and world food supplies survey, civilization and water, forests and timber, livestock, wildlife management and the aquatic environment. The urban environment is described by discussions on the problem of population and the need for energy and for minerals. The final chapters describe the action for conservation which needs to be implemented and the vanishing wildlife and resources which necessarily follow environmental degradation. The conclusions contend our treatment of the environment determines our future. To guarantee a high quality of living and a wide range of human choice for the future action must begin immediately. Each chapter ends with a list of literature cited as well as with a list of general references on the subject discussed.—Copyright 1972, Biological Abstracts, Inc.
W73-11170

QUALITATIVE VALUES IN ENVIRONMENTAL PLANNING: A STUDY OF RESOURCE USE IN URBANIZING WATERSHEDS,
Harvard Univ., Cambridge, Mass., Dept. of Land-scape Architecture.

For primary bibliographic entry see Field 05G.
W73-11253

ENVIRONMENTAL TERMINOLOGY INDEX.
Oak Ridge National Lab., Tenn. Environmental Information Systems Office.

For primary bibliographic entry see Field 10C.
W73-11387

THE FRESHWATER STREAM, A COMPLEX ECOSYSTEM,

Louisville Univ., Ky. Dept. of Biology.

L. A. Krumholz, and S. B. Neff.
Water Resources Bulletin, Vol 6, No 1, p 163-174, January-February 1970. 6 fig, 1 tab, 52 ref. OWRR B-005-KY (3).

Descriptors: *Ecosystems, *Streams, *Ecotopes, Environmental effects, Streamflow, Currents (Water), Channel morphology, Turbidity, Biological communities, Ecology, Water pollution, Environmental gradient, Speciation, Reviews, Evaluation.

The key to understanding the stream ecosystem is the unidirectional flow of the water mass it moves downhill. All water does not move toward the mouth at the same rate. Irregularities in the substrate cause a constant mixing and turbulence. Physical and chemical aspects of a stream ecosystem are generally favorable for aquatic life. The current and unidirectional flow exert a profound influence on those factors. Turbidity is influenced directly by current and, in turn, influences light penetration in the water. The amount and quality of light relates directly to photosynthesis in the stream and has a direct bearing on biological productivity. The numerous organisms and the variety of species that make up stream communities reflect their adaptations to the physical and chemical environment. Conducting an ecological survey of a stream ecosystem entails more than the preparation of a list of the species encountered. Sound information on the relative abundance of each species is required, and the ways in which the various species interact to keep the system going must be determined. (Woodard-USGS)
W73-11389

ENERGY VS. ENVIRONMENT,

B. C. Netschert.

Harvard Business Review, Vol 51, No 1, p 24-26, 28, 133-134, 138, 140, Jan-Feb 1973. 2 chart, 3 ref.

Descriptors: *Environmental effects, Energy, *Energy conversion, Energy transfer, *Pollution abatement, Consumption, Economics, Costs, Environment, Population, Electric power costs, Electric power production, Electric power demand, Efficiencies, Technology, Gasoline, Oil, Natural gas, Coal, Nuclear energy.

Identifiers: *Environmental quality, Living costs, Mass transit systems, Living standards, Environmental statements.

The production, conversion, and utilization of energy are responsible for many of today's environmental problems. Aggregate consumption of energy in the US has increased with population increases, but power consumption has outdistanced population growth, reflecting the general affluence of the people. The energy/environment conflict has already brought on supply difficulties and higher prices. Continued growth in energy demand can have but one effect, intensification of conflict and enlargement of the consequences. Higher prices for all are the general prospect which should create incentives to use energy more carefully, thus curtailing demand growth. Achieving greater efficiency in energy production and use should affect the energy growth rate. Technological developments now in the offing should resolve conflict of energy needs and pollution abatement. (USBR)
W73-11500

ECONOMIC GROWTH AND ENVIRONMENTAL IMPACT: EVALUATING ALTERNATIVES,
University of Southern California, Los Angeles.
For primary bibliographic entry see Field 06B.
W73-11511

PREIMPOUNDMENT STUDY, CARTERS LAKE.

Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab.

Available from NTIS, Springfield, Va 22151, as PB-213 307, Price \$3.00 printed copy; \$0.95 microfiche. Report, March 1972. 63 p, 9 fig, 8 tab, 5 ref, 5 append.

Descriptors: *Hydrologic data, *Pre-impoundment, *Reservoirs, *Georgia, Water analysis, Water quality, Forecasting, Recreation facilities, Water pollution sources, Thermal stratification, Environmental effects, Eutrophication.
Identifiers: *Carters Lake (Ga).

RESOURCES DATA—Field 07

Data Acquisition—Group 7B

The Carters Lake (Georgia) preimpoundment study was conducted over a period of three years. With some local exceptions, the waters to be impounded for Carters Lake are of good quality. Secondary treatment and chlorination of municipal and industrial wastes from Ellijay, coupled with accelerated bacterial die-off associated with impoundment, should permit full use of Carters Lake as a desirable recreational area. Thermal stratification in this unusually deep reservoir will cause depressed dissolved oxygen levels and possible increases in dissolved iron and manganese in the hypolimnia. Downstream water quality (DO, iron, manganese, odor) could be adversely affected by hypolimnetic discharges. Effects of pumped storage on quality of release waters and reservoir stratification are not known in this specific case, but are expected to be beneficial. The current potential for occurrence of nuisance biological problems associated with reservoir eutrophication is low, but development of the watershed and reservoir periphery could increase the possibility of accelerated eutrophication. (Woodard-USGS)
W73-11530

07. RESOURCES DATA

7A. Network Design

WATER SAMPLING GUIDELINES AND INTERPRETATION OF DATA, Environmental Health Lab., McClellan AFB, Calif.

R. V. Coyne, J. M. Campbell, and E. G. Robles, Jr. Available from NTIS, Springfield, Va. 22151 as AD-752 537 Price \$3.00 printed copy; \$0.95 microfiche. Professional Report No. 72M-5, March 1972. 51 p, 4 append.

Descriptors: *Water sampling, *Water analysis, *Chemical analysis, Methodology, Sampling, Preservation, Dissolved solids, Inorganic compounds, Surfactants, Turbidity.
Identifiers: *Water sampling guidelines.

A variety of aspects and associated problems of a water sampling program are discussed in an effort to make the data derived from that program more valid and more informative. Sampling data have meaning only where: (1) a water quality surveillance program is in force, (2) the objective of the sampling program is well defined, (3) samples are representative of the water source, (4) samples are preserved so as to maintain their quality until analyzed, and (5) the results of the analytical procedures are applied in conjunction with other pertinent data. A sample is no better than the poorest of those aspects. This does not mean that a random sample has no merit, but in most cases the objective of a sampling program is to allow a time differential comparison with other samples taken at the same location. Before this comparison can be valid, all the variables must be known and controlled. For this report, it is assumed that an adequate water quality surveillance program has been established and that the sampling stations have been selected. Based on that assumption, the mechanics of field data and sample collection, handling of the samples, and interpretation of the analytical report are discussed. (Woodard-USGS)
W73-11205

GEONATURAL RESOURCE PLANNING, PROPOSED GUIDELINES FOR A DETAILED GEONATURAL RESOURCE INVENTORY AND ANALYSIS REQUIRED TO UNDERTAKE A COMPREHENSIVE PLANNING AND DEVELOPMENT FOR ALBANY/DOUGHERTY COUNTY, GEORGIA, Albany-Dougherty County Planning Commission, Albany, Ga. S. J. Meltz. February 1972. 20 p, 83 ref.

Descriptors: *Evaluation, *Natural resources, *Comprehensive planning, *Methodology, Regional development, Georgia, Data collections, System analysis, Optimum development plans.
Identifiers: Albany-Dougherty County (Georgia).

The future development of the Albany-Dougherty County, Georgia Metropolitan area will depend on an accurate assessment of the natural resources and environment of the region. Geonatural resources include all of the physical natural resources of the earth, such as air, water and land. A framework for evaluating these resources as they relate to future planning and development is outlined. The geonatural resources are identified as: (1) air, (2) water, (3) land, (4) minerals, (5) forest, and (6) marine. Resource problems include pollution, human needs of food, shelter and clothing, and human supportive capacity factors of population size, growth rate and population distribution. Many options exist for resource allocation or acquisition. Under land, for example, the land can be: (1) public, (2) private, (3) forest, (4) range, (5) estuary or wetlands, or (6) mined land. Tools are needed to conduct and implement the geonatural resource evaluation program, including accurate mapping and analysis of geographic, geologic, demographic, climatic, and ecological factors. All information must be analyzed on the basis of the total system under consideration, consistent with program goals and objectives for the future development of the area. (Poertner)
W73-11672

7B. Data Acquisition

DIRECT DETERMINATION OF THE ELECTROMAGNETIC REFLECTION PROPERTIES OF SMOOTH BRACKISH WATER TO THE CONTINUOUS SPECTRUM FROM 100 MILLION TO 4 BILLION HERTZ, Hawaii Univ., Honolulu. Water Resources Research Center. For primary bibliographic entry see Field 02L. W73-11052

SPECTRA OF TURBULENT FLUCTUATIONS OVER OCEAN WAVES, Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 02B. W73-11087

PRINCIPLES OF LANDSLIDE IDENTIFICATION FROM AERIAL SURVEY DATA (PRINTSIPI RASPOZNAVANIYA OPOLZNEVYKH PROTSESSOV "YEMKI"), Moscow State Univ. (USSR). Chair of Aerofotos "Yemki". For primary bibliographic entry see Field 02J. W73-11100

UNSUPERVISED SPATIAL CLUSTERING WITH SPECTRAL DISCRIMINATION, National Aeronautics and Space Administration, Huntsville, Ala. George C. Marshall Space Flight Center. For primary bibliographic entry see Field 07C. W73-11116

A NEW METHOD FOR THE SOIL MOISTURE MEASUREMENT (MOMIN'S METHOD), For primary bibliographic entry see Field 02G. W73-11117

SURVEY OF APPLICATION OF RADIATION TO PREPARATIVE CHEMISTRY, National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center. For primary bibliographic entry see Field 02K. W73-11119

REMOTE SENSING TECHNIQUES FOR DETECTING OIL SLICKS,
National Aeronautics and Space Administration, Washington, D.C.
For primary bibliographic entry see Field 05A.
W73-11137

A SMALL DIMENSION PROBE FOR THE DETERMINATION OF GROUND WATER FLOW DIRECTION,
Technical Univ., Lodz (Poland).
For primary bibliographic entry see Field 02F.
W73-11200

THE USE OF OCEAN TIDE RECORDS TO DETECT MOTIONS PREMONITORY TO A TECTONIC EVENT IN THE LONG BEACH, CALIFORNIA AREA,
Naval Postgraduate School, Monterey, Calif.
B. D. Wyman.
Available from NTIS, Springfield, Va. 22151, AD-753 596, Price \$3.00 printed copy; \$0.95 microfiche. M Sc Thesis, September 1972. 74 p, 17 fig, 9 tab, 44 ref.

Descriptors: *Tsunamis, *Ocean waves, *Waves (Water), *Earthquakes, Tides, Data collections, Computer programs, Methodology, Water levels, Correlation analysis, Meteorology, Ocean currents, *California.
Identifiers: Residual time series, Geological motions, Tectonic motions.

The goal was to extract the most powerful harmonic portions of the ocean tides and the meteorological effects from series of ocean tide level observations from several stations to generate residual time series reflecting geological and tectonic motions at the stations. Marigram records of ocean tide fluctuations at three tide stations operating in the Santa Monica/Long Beach, California, area at the time of the March 10, 1933, Long Beach earthquake (magnitude 6.3) were digitized onto magnetic tape. Time series of hourly instantaneous tide level observations were generated and processed under a least squares criterion to remove the effects of the nine most energetic lines of the ocean tide harmonic spectrum. The resulting residual series did not contain any anomalous premonitory motions indicated by another residual series previously analyzed at the National Center for Earthquake Research. Auto- and Cross-correlations of the three residual series used revealed only two possibly significant autocorrelation peaks for two stations lagging themselves by 24 hours. (Woodard-USGS)
W73-11214

AN EVALUATION OF THE UTILITY OF AVAILABLE REMOTE SENSOR RETURNS FOR A STUDY OF SLOPE FAILURE PHENOMENA,
East Tennessee State Univ., Johnson City, Dept. of Geology.
D. H. Poole.

Available from NTIS, Springfield, Va. 22151 as AD-750 735, Price \$3.00 printed copy; \$0.95 in microfiche. Remote Sensing Institute Technical Report 14, 1972. 36 p, 25 fig. ONR N00014-67-A-0102-0001.

Descriptors: *Slope stability, *Degradation (Slope), *Remote sensing, *Aerial photography, *North Carolina, Bank erosion, Photogrammetry, Cameras, Terrain analysis, Infrared radiation, Methodology, Correlation analysis, Photography, Aircraft.
Identifiers: Ektachrome, Ektachrome infrared, Panchromatic, Multi-spectral photography.

The utility of the photographs from NASA's North Carolina test site 46 for studying slope failure phenomena is evaluated. Slope failure forms depicted by the photography include both erosional and mass wastage forms. The imagery

Field 07—RESOURCES DATA

Group 7B—Data Acquisition

made available to the investigator includes Ektachrome, Ektachrome infrared, panchromatic and multi-spectral nine-lens photography. The Ektachrome and Ektachrome infrared were available from each of the five missions conducted in the area of study. The multi-spectral nine-lens was available from two missions, and the panchromatic photography was available from a single mission. Of all the photographs made available the Ektachrome, Ektachrome infrared, and multispectral nine-lens afforded the most complete coverage. The usable portions of these photographs contained resolution and scale properties ranging from fair to good and registered satisfactory signatures of the whole range of slope failure forms under consideration. (Woodard-USGS) W73-11216

METHOD AND APPARATUS FOR DETECTING THE HARDNESS LEVEL OF WATER,
Erie Mfg. Co., Milwaukee, Wis. (assignee)
R. K. Engholdt.
U. S. Patent No. 3,729,263, 4 p, 1 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 909, No 4, p 1322, April 24, 1973.

Descriptors: *Patents, *Water treatment, *Sampling, *Hardness (Water), *Water quality, *Water softening, Equipment.

A control for detecting the hardness level of water comprising a sampling means for periodically extracting a sample of water from the water system and mixing it with a reagent which is formulated to cause the sample to change color at a predetermined hardness level. The mixed sample is exposed to a detection device which includes a bridge circuit and a voltage-sensitive device connected to the bridge circuit for sensing an unbalanced condition in the bridge circuit. A pair of photo-conductive cells are connected in series in one leg of the bridge circuit. When the hardness of the samples is below a preselected level it will take on the color of the filter element (when mixed with the reagent) and the light falling on both cells will be substantially the same color and intensity and thus the bridge circuit will remain in a balanced condition. When the sample is above the preselected hardness level it will assume a different color from that of the filter element. When this happens the color and intensity of the light falling on the two cells will be different causing the bridge circuit to become unbalanced. The voltage-sensitive means will sense the unbalance condition and produce a signal which may be used for example to initiate the regeneration cycle of a water softener apparatus. (Sinha-OEIS) W73-11227

LIQUID SAMPLING,
Pro-Tech, Inc., Malvern, Pa. (assignee).
M. D. Rutkowski, and R. K. Stanley.
U. S. Patent No 3,727,464, 6 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 909, No 3, p 859, April 17, 1973.

Descriptors: *Patents, Streams, Rivers, *Monitoring, Pollution abatement, *Water quality, Water analysis, *Water sampling, *Industrial wastes, *Treatment facilities.

Repetitive sampling of liquid from a body is controlled in frequency, dependent upon the depth of the liquid being sampled. Such depth-proportioning is accomplished using pressurized gas as a propulsion fluid and determining sampling frequency by gradual release of the gas to accumulate to a switching pressure at a given location through bleeding off part of the accumulating gas against the back pressure of the depth of liquid. (Sinha-OEIS) W73-11235

AERIAL SURVEILLANCE SPILL PREVENTION SYSTEM,
McDonnell Aircraft Co., St. Louis, Mo. Reconnaissance Lab.
For primary bibliographic entry see Field 05B.
W73-11326

THE U.C.S. GRAIN-SIZE COMPARATOR DISC,
Unit of Coastal Sedimentation, Taunton (England).
R. Kirby.
Marine Geology, Vol 14, No 3, p M11-M14, March 1973. 2 fig, 2 ref.

Descriptors: *Particle size, *Measurement, *Instrumentation, Sedimentology, Sands, Silts, Clays, Estimating, Sampling, Bottom sediments.

A perspex disc produced for the purpose of measuring particle sizes in unconsolidated sediment samples in the field has eight segmented compartments containing standard samples ranging from granules to clay. The sample to be sized is placed over the clear perspex area of the disc and sized by visual comparison with the fractions in the segments. (Knapp-USGS) W73-11395

THE INFERENCE OF ATMOSPHERIC OZONE USING SATELLITE NADIR MEASUREMENTS IN THE 1042/CM BAND,
National Aeronautics and Space Administration, Langley Station, Va. Langley Research Center. J. M. Russell, III, and S. R. Drayson.

Available from NTIS, Springfield, Va. 22151 NASA TR R-399 Price \$3.00 printed copy; \$0.95 microfiche. National Aeronautics and Space Administration Technical Report R-399, March 1973. 53 p, 20 fig, 7 tab, 64 ref.

Descriptors: *Atmosphere, *Ozone, *Remote sensing, *Infrared radiation, Measurement, Instrumentation, Satellites (Artificial), Boundary layers, Analytical techniques, Equations.

Identifiers: Infrared spectral region, Stratosphere, Troposphere.

A description and detailed analysis are presented of a technique for inferring atmospheric ozone information from satellite nadir measurements in the 1042/cm band. A method is formulated for computing the emission from the lower boundary under the satellite which circumvents the difficult analytical problems caused by the presence of atmospheric clouds and the water-vapor continuum absorption. The inversion equations are expanded in terms of the eigenvectors and eigenvalues of a least-squares-solution matrix, and an analysis is performed to determine the information content of the radiance measurements. Under favorable conditions there are only two pieces of independent information available from the measurements: the total ozone (u) and the altitude of the primary maximum in the ozone profile. An error analysis shows that errors in u are affected most by random radiance noise, lower boundary temperature errors, and ozone absorption-line intensity errors. Errors in altitude are affected most by the former two errors and also by temperature-profile bias errors.

The results when all errors are considered simultaneously indicate that it should ultimately be possible to determine u to within 10% or less and to determine altitude to within 1.5 km when the root-mean-square radiance noise level is 1% or less.

The calculations are also made for various degrees of cloudiness in the troposphere. The presence of clouds does not seriously affect results as long as there is some contrast between the ozone spectrum and the lower boundary emission spectrum. Finally, the inversion technique is applied to radiances measured from a balloon over Palestine, Texas, and to Nimbus III satellite data measured over the Bahama Islands. (Woodard-USGS) W73-11400

PHOTOGRAPHIC WATER CONSERVATION AND RECLAMATION PROCESSES STUDY,
Eastman Kodak Co., Rochester, N.Y.
For primary bibliographic entry see Field 05A.
W73-11403

REMOTE SENSING EVALUATION OF ENVIRONMENTAL FACTORS AFFECTING THE DEVELOPMENTAL CAPACITY OF INLAND LAKES,
Toronto Univ. (Ontario). Inst. of Environmental Sciences and Engineering. S. J. G. Bird.

Available from NTIS, Springfield, Va. 22151 as N 72-29298 Price \$3.00 printed copy; \$0.95 microfiche. Presented at the First Canadian Remote Sensing Symposium, February 9, 1972, Ottawa, Ontario, Canada, 1972. 19 p, 1 fig, 1 tab, 1 ref.

Descriptors: *Remote sensing, *Aerial photography, *Lakes, *Limnology, *Canada, Hydrologic aspects, Inflow, Discharge (Water), Lake morphology, Lake shores, Lake beds, Evaluation, Inland waterways.

Identifiers: Infrared color.

The multidisciplinary aspects of remote sensing are defined and applied to a specific investigation concerning the developmental capacity of the inland lakes of Ontario. The paper is presented in six sections: multidisciplinary aspects of remote sensing; purposes and phasing of lake capacity study; regional uses of remote sensing for lake capacity study; evaluation of parameters using remote sensors; specialized studies required in remote sensing; and conclusions and recommendations. High altitude photography would be extremely useful in establishing waterway connections, particularly infrared color which so reliably registers moisture content variations, thus confirming inflow and outlet points. (Woodard-USGS) W73-11540

INVESTIGATION OF INFRARED ANOMALIES IN THE LAC DES DEUX MONTAGNES AREA, QUEBEC,
Department of the Environment, Ottawa (Ontario). Water Resources Branch. P. A. Carr, and H. Gross. Inland Waters Directorate Scientific Series No 19, 1972. 16 p, 5 fig, 2 tab, 11 ref.

Descriptors: *Remote sensing, *Groundwater movement, *Infrared radiation, *Surface-groundwater relationships, *St. Lawrence River, Canada, Surveys, Hydrogeology, Instrumentation, Water temperature.

In October 1965 infrared scanners were used in investigation of infrared anomalies related to groundwater discharge into the Ottawa River. On the basis of this survey, the Lac des Deux Montagnes area, on the Ottawa River just above its junction with the St. Lawrence River, was selected for more intensive study in 1968 and 1969. Comparison of imagery and published geological work led to the conclusion that no positive identification of groundwater discharge was made; however, it is possible that one anomaly, just southeast of Pointe Cavaignal, is caused by groundwater influx into the river along its bottom. (Knapp-USGS) W73-11541

APPLICATION OF REMOTE SENSING TECHNIQUES TO MEASUREMENT OF USE OF OUTDOOR RECREATION RESOURCES,
Tennessee Univ., Knoxville. Dept. of Forestry. K. F. Schell, and J. H. Taft. Department of Interior Bureau of Outdoor Recreation Interagency Report USGS-256, September 1972. 110 p, 2 tab, 112 ref, 4 append. BOK Contract 2-14-02-1.

RESOURCES DATA—Field 07

Evaluation, Processing and Publication—Group 7C

Descriptors: *Remote sensing, *Recreation facilities, Census, Planning, Methodology, Aerial photography, Aircraft, Radar, Evaluation, Costs. Identifiers: *Dinade sensing system.

Remote sensing techniques were used to measure the number of individuals engaged in a specific outdoor recreation activity at a specific time. Aerial sensors received the most attention after initial study of satellite and high-altitude aircraft systems showed they offer no promise at this time for measuring recreation use. The DINADE-type system (similar to radar) probably has more potential than any other system encountered; however, the development costs for this single purpose could be prohibitive. Efforts to improve ground-based methods such as time-lapse or activated photography could be supply virtually constant monitoring. (Woodard-USGS)
W73-11546

APPLICATIONS OF MULTISPECTRAL REMOTE SENSING TECHNIQUES TO HYDROBIOLOGICAL INVESTIGATIONS IN EVERGLADES NATIONAL PARK, Geological Survey, Tallahassee, Fla.

A. L. Higer, N. S. Thomson, F. J. Thomson, and M. C. Kolipinski.
Michigan University Willow Run Laboratories and U.S. Geological Survey joint report, Technical Report 2528-5-T, January 1970, 25 p., 7 fig., 2 tab., 4 ref. USGS Contract WRD-4012-632-69.

Descriptors: *Remote sensing, *Spectroscopy, *Hydrobiology, *Marshes, *Florida, Aquatic plants, Vegetation, Trees, Mapping, Analytical techniques, Aircraft, Soil-water-plant relationships, Management.

Identifiers: *Everglades National Park, *Multispectral imagery.

Multispectral data collection and processing techniques were used to map tree islands, emergent aquatic grassland vegetation, surface water of two different depths, and exposed limestone in a portion of the Everglades National Park in south Florida. Before multiband scanners, photographic techniques were the only practical way to inventory hydro-biological features in the park. Mapping with multiband-scanner data was tried here for the first time on a strip of park land 8 miles long and 2,000 ft wide, in September 1967. The recognition maps were produced by electronically processing selected combinations of video signals in the narrow spectral bands between 0.4 and 1.0 micrometers. The computer recognition maps were printed in different colors and superposed to provide a color-composite recognition map of the area. Periodic data collection and processing in this form would yield quantitative data concerning the direction and extent of plant successional changes. This in turn would provide more accurate information for water management practices in the park. (Woodard-USGS)
W73-11553

FALLING-DROP TECHNIQUE FOR SILT-CLAY SEDIMENT ANALYSIS,

Wisconsin Univ., Green Bay. Coll. of Environmental Sciences.
For primary bibliographic entry see Field 05A.
W73-11558

NATURAL RESOURCE INFORMATION SYSTEM REMOTE SENSING STUDIES,

Boeing Computer Services, Inc., Seattle, Wash. J. Leachtnauer, R. Hirsch, V. Williams, and R. Tucker.
Available from NTIS Springfield, Va. 22151, as PB-211 384, Price \$3.00 printed copy; \$0.95 microfiche. Report, May 1972, 110 p., 9 fig., 14 tab., 89 ref., 1 append. BIA K51C14200459.

Descriptors: *Remote sensing, *Land management, *Water resources, *Aerial photography, Systems analysis, Input-output analysis, Forestry, Range management, Mapping, Soil types, Vegetation, Trees, Classification, Natural resources.

A major design objective of the Natural Resources Information System entailed the use of remote sensing data as an input to the system. A literature review was conducted to determine the types and qualities of imagery required to satisfy identified data needs. Ektachrome imagery available over the demonstration areas was reviewed to establish the feasibility of interpreting cultural features, range condition, water resources, and forestry. Using the same imagery, a land use map was prepared for the demonstration area. In the area of water resources and hydrology a great number of applications of remote sensing have been tested. These include studying drainage patterns where detailed map coverage is lacking; taking a census of water resource features, both natural and man-made, such as springs, wells, ponds, detentions, diversions, and canals; studying water quality in terms of industrial, mining, or agricultural pollutants; and analyzing regional geomorphology in order to understand the groundwater and surface water regimes. A total of 22 studies covering hydrology applications were reviewed. (Woodard-USGS)
W73-11571

SYSTEM STUDY FOR SURVEILLANCE OF OCEAN DUMPING OPERATIONS.

Sperry Rand Corp., Great Neck, N.Y. Sperry Systems Management Div.
For primary bibliographic entry see Field 05B.
W73-11573

APPLICATIONS OF REMOTE SENSING TECHNIQUES TO BUOY-BASED ENVIRONMENTAL DATA GATHERING,

National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
For primary bibliographic entry see Field 05A.
W73-11631

COMPREHENSIVE REGIONAL WATER AND SEWER INVENTORY AND ANALYSIS,

Alabama-Tombigbee Rivers Regional Planning and Development Commission, Camden. S. J. Smyth.

Available from the National Technical Information Service as PB-211 482, \$8.50 in paper copy, \$0.95 in microfiche. June 1972, 123 p., 22 fig., 20 tab. ALA-TOM-72-02.

Descriptors: *Data collections, *Sewerage, *Water supply, Planning, Regional development, Evaluation, Alabama, Water distribution (Applied), Water works, Sewers, Sewerage disposal, Water quality, Water quantity, Analysis, Assessment.

A complete inventory and analysis of existing water and sewer facilities was made in the ten-county Alabama-Tombigbee Rivers Regional Planning and Development Commission area. This information will be used to form a comprehensive regional water and sewer plan. The region covers more than 9,600 square miles and had a 1970 population of 223,900. In general, the region has a rural, poor, agrarian society that has an abundance of human and natural resources. Most of the area is forest land and the timber industry is the largest part of the economy. A major obstacle in the preparation of this report was the lack of sufficient data, especially for the smaller communities and unincorporated areas. The water systems were examined from three main areas of concern: (1) quantity and quality of the water, (2) the treatment facility, and (3) the distribution system. A total of forty-four public and private systems, serving 40.8 percent of the area's population, derive their water

from both ground and surface supplies. The sewerage system was examined in terms of the collection system and disposal facilities. There are eighteen public sewerage systems serving 30.6 percent of the area's population. (Poertner) W73-11670

GEONATURAL RESOURCE PLANNING, PROPOSED GUIDELINES FOR DETAILED GEONATURAL RESOURCE INVENTORY AND ANALYSIS REQUIRED TO UNDERTAKE A COMPREHENSIVE PLANNING AND DEVELOPMENT FOR ALBANY/DOUGHERTY COUNTY, GEORGIA, Albany-Dougherty County Planning Commission, Albany, Ga.
For primary bibliographic entry see Field 07A.
W73-11672

7C. Evaluation, Processing and Publication

A CATALOG OF HYDROCLIMATOLOGICAL DATA FOR ALASKA'S COASTAL ZONE, Alaska University, College. Inst. of Water Resources.

For primary bibliographic entry see Field 02B.
W73-11056

AN INVENTORY OF SUSPENDED SEDIMENT STATIONS AND TYPE OF DATA ANALYSIS FOR PENNSYLVANIA STREAMS, 1947-70, Geological Survey, Harrisburg, Pa. Water Resources Div.

For primary bibliographic entry see Field 02J.
W73-11083

WATER RESOURCES DATA FOR ALABAMA, 1970: PART 2. WATER QUALITY RECORDS, Geological Survey, University, Ala.

For primary bibliographic entry see Field 02K.
W73-11085

VIRGINIA SMALL STREAMS PROGRAM, PRELIMINARY FLOOD-FREQUENCY RELATIONS, Geological Survey, Richmond, Va.

For primary bibliographic entry see Field 02E.
W73-11090

GROUNDWATER DATA IN THE CORVALLIS-ALBANY AREA, CENTRAL WILLAMETTE VALLEY, OREGON, Geological Survey, Portland, Oreg.

For primary bibliographic entry see Field 04B.
W73-11093

FLOOD OF JUNE 9-10, 1972, AT RAPID CITY, SOUTH DAKOTA, Geological Survey, Washington, D.C. O. J. Larimer.

Available for sale by USGS, Washington, D.C. 20244, Price 75 cents. Hydrologic Investigations Atlas HA-511, 1973. 1 sheet, 7 fig., 1 map, 5 ref.

Descriptors: *Floods, *Flood data, *Flood damage, *Flood profiles, *South Dakota, Streamflow, Flow rates, Gaging stations, Flood peak, Peak discharge, Correlation analysis, Historic floods, Maps, Curves.

Identifiers: *Rapid City (S Dak).

This Atlas was prepared to describe the floods of June 9-10, 1972, in the immediate vicinity of Rapid City, South Dakota. The peak stage of 15.77 feet at the gaging station above Canyon Lake was 7.69 feet higher for the June 9-10, 1972, flood than the previous peak stage of record of May 23, 1952; the peak discharge of 31,200 cfs was 12 times that of

Field 07—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

the flood of May 23, 1952, the previous maximum peak discharge in 26 years of record. At the gaging station in Rapid City, the peak of June 9-10, 1972, was 50,000 cfs, more than 15 times the previous maximum of 3,300 cfs on July 13, 1962. The stage of 15.45 feet was 7.08 feet higher than the previous peak of record on July 13, 1962. The extent of inundation from Rapid Creek in and around Rapid City is shown on a topographic base map. Inundation boundaries were identified from field inspections. The relation of the 50-year flood to drainage area for the Rapid City region is plotted. Also plotted are the peak discharges for the flood of June 9-10, 1972, at all points measured. These peaks exceed the 50-year discharge by several orders of magnitude. (Woodard-USGS) W73-11105

GROUND WATER IN FINNEY COUNTY, SOUTHWESTERN KANSAS, Geological Survey, Washington, D.C.

E. D. Gutentag, D. H. Lobmeyer, H. E.

McGovern, and W. A. Long.

For sale by U. S. Geological Survey, Washington, D.C. 20244, for \$1.25 per set. Hydrologic Investigations Atlas HA-442, 1972. 3 sheets, 13 fig, 3 tab, 13 ref.

Descriptors: *Groundwater resources, *Hydrogeology, *Water wells, *Water quality, *Kansas, Hydrologic data, Maps, Hydrographs, Water level fluctuations, Aquifer characteristics, Well data, Pumping, Water utilization, Water yield, Irrigation, Groundwater recharge, Chemical analysis.

Identifiers: *Finney County (Kans).

This 3-sheet hydrologic atlas describes groundwater conditions in Finney County, Kansas. Water in the Tertiary and Quaternary deposits ranges from a calcium bicarbonate type to a calcium sodium sulfate type, and generally is very hard. Water in the undifferentiated Lower Cretaceous rocks ranges from a sodium bicarbonate type to a sodium sulfate type. Areas are designated on a map with a summary table and geologic sections grouped according to similar hydrologic conditions that affect water quality in the Tertiary and Quaternary deposits. The geologic section shows the direction of groundwater movement as related to the changes in water quality. The concentrations of dissolved solids in the undifferentiated Upper Jurassic and Lower Cretaceous rocks increase from less than 300 mg/liter to more than 2,500 mg/liter as the depth and distance from the area of recharge increase. The increasing utilization of groundwater for irrigation has resulted in a decline in water levels with an accompanying loss of water from storage. Water-level declines from 1940 to 1968 range from less than 10 to more than 40 feet. (Woodard-USGS) W73-11106

UNSUPERVISED SPATIAL CLUSTERING WITH SPECTRAL DISCRIMINATION, National Aeronautics and Space Administration, Huntsville, Ala. George C. Marshall Space Flight Center.

R. R. Jayroe, Jr.

Available from NTIS, Springfield, Va 22131 as NASA TN D-7312, Price \$3.00 printed copy; \$0.95 microfiche. Technical Note TN D-7312, May 1973. 85 p, 28 fig, 10 tab, 25 ref.

Descriptors: *Data processing, *Natural resources, *Remote sensing, *Satellites (Artificial), *Computer programs, Methodology, Classification, Equations.

Identifiers: *Earth resources, Clustering.

The recent development of manned and unmanned space vehicles has brought about an almost unprecedented advance in studies of remotely sensed earth observations. These observations require a multidisciplinary study which includes such fields

as agriculture, forestry, geography, demography, cartography, geology, meteorology, hydrology, oceanography, environmental quality, ecology, sensor technology, and interpretation techniques development. With this advance comes an unprecedented amount of data. The problem arises of how to analyze and extract information from such large volumes of data in an efficient manner. The main emphasis of this work is the development of a computer program for extracting features from remotely sensed data presented in digital image form. This computer program requires no human supervision or judgement and operates unassisted on the raw digital data. Also included are a condensed general background on remote sensing of earth features and a short synopsis on some of the most commonly used types of feature extraction techniques. This discussion is followed by a presentation of results obtained from the unsupervised feature extraction computer program along with a description and listing of the computer program. (Woodard-USGS) W73-11116

GROUNDWATER LEVELS IN NEBRASKA, 1972, Geological Survey, Lincoln, Nebr.

For primary bibliographic entry see Field 04B.
W73-11117

RELATIONSHIPS BETWEEN SATURATED HYDRAULIC CONDUCTIVITY AND MORPHOMETRIC DATA OF AN ARGILLIC HORIZON, Wisconsin Geological and Natural History Survey, Madison.

For primary bibliographic entry see Field 02G.
W73-11211

ANNUAL COMPILED AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE FORT WORTH, TEXAS, METROPOLITAN AREA, 1971, Geological Survey, Fort Worth, Tex.

For primary bibliographic entry see Field 04C.
W73-11215

FREEZE-FREE (32 F) SEASONS OF THE MAJOR BASINS AND PLATEAUS OF NEVADA, National Weather Service, Reno, Nev. Weather Service Office.

C. M. Sakamoto, F. F. Peterson, E. A. Naphan, H.

P. Cords, and H. R. Guenther.

Nevada State Engineers Office, Carson City, Division of Water Resources Map S-14, 1973. 1 sheet, 1 map, 4 tab, 2 ref.

Descriptors: *Horticultural crops, *Agriculture, *Temperature, *Nevada, *Crop production, Climate zones, Maps, Land use, Topography, Vegetation, Soil-water-plant relationships.

Identifiers: Freeze-free seasons (Nev.).

This map (scale 1:750,000) shows the freeze-free (32 deg F) seasons of the level to rolling basins and plateaus of Nevada. These are the areas of greatest potential for agricultural or urban development. The major crops adapted to Nevada's different freeze-free zones are listed to indicate the agricultural potential of lands in the zones. Hydrographic areas used for state-wide water management are shown as part of the base maps. Five classes of freeze-free season length, or zones, are given. Zone 1 includes areas of more than 200 days' freeze-free season; zone 2 includes areas of 130- to 200-day season; zone 3 includes areas of 100- to 130-day season; zone 4 includes areas 70- to 100-day season and zone 5 includes those areas of less than 70-day freeze free season. These season lengths give useful predictions of crop adaptability based on current knowledge of Nevada's climate and crops. Freeze-free seasons are shorter in northern than southern Nevada, and

also are shorter for basins at higher elevations at the same latitude. The longest seasons are in the low basins of southern Nevada, whereas the shortest seasons are in the high basins of east-central Nevada and across its northern basins and plateaus. The extent of each zone, and other geographic attributes, are shown. (Woodard-USGS) W73-11218

BATHYMETRIC RECONNAISSANCE OF WILD HORSE RESERVOIR, ELKO COUNTY, NEVADA, Geological Survey, Carson City, Nev.

T. L. Katzer, and L. Harmen.

Nevada Division of Water Resources, Carson City, Water Resources Information Series Report 16, 1973. 1 sheet, 5 fig, 1 map, 2 tab, 1 ref.

Descriptors: *Limnology, *Reservoirs, *Bathymetry, *Nevada, Sedimentation, Water quality, Streamflow, Inflow, Discharge (Water), Chemical analysis, Evaporation, Hydrologic data, Maps, Curves, Sedimentation, Water temperature.

Wild Horse Reservoir is in Elko County, Nevada, on the northeastern flank of the Independence Mountains, about 62 miles north of Elko and 12 miles southeast of Mountain City, on State Route 51. The drainage area of the Owyhee River (the main tributary to Wild Horse Reservoir) at the gaging station immediately below the reservoir is about 209 square miles. The reservoir is operated to provide irrigation water for about 21,000 acres of Indian land. A continuous recording, electronic fathometer was used to measure the depth of the reservoir on 48 traverses. The bathymetric survey was made on May 25-26, 1972, when the reservoir was spilling at stage, 6,205.6 feet. At spillway elevation, 6,205 feet, the water-surface area is 2,830 acres and the storage capacity is 73,500 acre-feet. There has been no identifiable loss of storage due to sedimentation, and therefore, sediment transport into Wild Horse Reservoir is assumed to have been minor. Water-quality data are tabulated for the sampling site downstream from Wild Horse Reservoir. (Woodard-USGS) W73-11219

BATHYMETRIC RECONNAISSANCE OF WEBER RESERVOIR, MINERAL COUNTY, NEVADA, Geological Survey, Carson City, Nev.

T. L. Katzer, and L. Harmen.

Nevada Division of Water Resources, Water Resources Information Series Report 15, 1973. 1 sheet, 5 fig, 1 map, 3 tab, 2 ref.

Descriptors: *Limnology, *Reservoirs, *Bathymetry, *Nevada, Sedimentation, Water quality, Water temperature, Chemical analysis, Maps, Curves, Streamflow, Inflow, Discharge (Water), Hydrologic data.

A continuously recording, electric fathometer was used to measure the depth of the Weber reservoir in Mineral County, Nevada, on 38 traverses. The reservoir was at maximum operating stage, 4,208.0 feet (considered full with 2 feet of freeboard left on radial spillway gates) during the survey on May 22-23, 1972. The stage-area-capacity figures indicate a water-surface area of 900 acres and a storage capacity of 10,700 acre-feet at stage 4,208 feet, or about 2,400 acre-feet less storage capacity than the original area-capacity figures. This represents an 18% loss of computed storage capacity. The maximum reservoir depth was 29 feet. An increase of sediment concentration was evident with depth of water, and more sediment moving into the reservoir (236 mg/liter) than was moving out (82 mg/liter). Chemical analyses of water samples collected during the 1971 water year at the Walker River gaging station near Wabuska are tabulated. Vertical temperature profiles taken on May 23, 1972, at two sites in the reservoir are shown. The water-inflow temperature at the head

ENGINEERING WORKS—Field 08

Evaluation, Processing and Publication—Group 7C

of the reservoir at that time was 21 deg C; the outflow temperature, taken as water was being released from the bottom of the reservoir, was 14.5 deg C. (Woodard-USGS)
W73-11220

STREAM DEPLETION FACTORS, ARKANSAS RIVER VALLEY, SOUTHEASTERN COLORADO: A BASIS FOR EVALUATING PLANS FOR CONJUNCTIVE USE OF GROUND AND SURFACE WATER,
Geological Survey, Lakewood, Colo.
For primary bibliographic entry see Field 04B.
W73-11221

WATER RESOURCES OF HEMPSTEAD, LAFAYETTE, LITTLE RIVER, MILLER, AND NEVADA COUNTIES, ARKANSAS,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04B.
W73-11222

URBANIZATION'S DRAINAGE CONSEQUENCE,
Nolte (George S.) and Associates, San Jose, Calif.; and San Diego County Comprehensive Planning Organization, Calif.
For primary bibliographic entry see Field 04C.
W73-11224

GENERIC FEED FORWARD CONTROL OF ACTIVATED SLUDGE,
Kentucky Univ., Lexington. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05D.
W73-11362

RIVER SYSTEMS TRANSITION FUNCTION AND OPERATION STUDY,
New York State Dept. of Environmental Conservation, Albany. Bureau of Water Resources Planning.
For primary bibliographic entry see Field 04A.
W73-11364

PROBABILISTIC SHORT-TERM RIVER YIELD FORECASTS,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W73-11366

WATER RECORDS OF THE U.S. VIRGIN ISLANDS, 1962-69,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W73-11396

GROUND-WATER BASIC DATA OF CAVALIER AND PEMBINA COUNTIES,
Geological Survey, Bismarck, N. Dak.
For primary bibliographic entry see Field 04B.
W73-11397

LOCATION AND DETERMINATION OF DEPTHS OF SUBSURFACE UNDULATIONS BY SEISMIC METHODS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08E.
W73-11398

HYDROLOGIC RECORDS FOR VOLUSIA COUNTY, FLORIDA: 1971-72,
Geological Survey, Tallahassee, Fla.
C. P. Laughlin, and D. M. Hughes.
Open-file report 72030, 1973. 51 p, 32 fig, 8 tab, 4 ref.

Descriptors: "Water resources," "Surface waters," "Groundwater," "Hydrologic data," "Florida, Basic data collections, Aquifers, Water wells, Water level fluctuations, Streamflow, Flow rates, Rainfall, Water yield, Water quality, Chemical analysis, Dissolved solids, Nutrients.
Identifiers: "Volusia County (Fla.)."

Volusia County, Fla., an area of 1,200 square miles, is in the central part of eastern coastal Florida. In 1970 the population of the county was 170,000, and increase of 35% over 1960. The population growth is reflected in increased demands on the county's water resource. In 1966 the U.S. Geological Survey began a program of hydrologic records collection for Volusia County in cooperation with the Board of County Commissioners of Volusia County through the Bureau of Geology, Florida Department of Natural Resources. Water quality and quantity are monitored at surface and groundwater data sites where previous comprehensive studies have indicated that such records are necessary for continuing management of the county's water resource. Hydrologic conditions in Volusia County are presented in tabular and graphic form. Data on wells, springs, and lakes are for May 1971 to May 1972; data on streams are for the 1971 water year, October 1, 1970 to September 30, 1971. In addition, data are included for two surface-water stations maintained in cooperation with the Florida Department of Transportation, for one surface-water station maintained in cooperation with the U.S. Army Corps of Engineers, and for several stations maintained in cooperation with the Florida Bureau of Geology. (Woodard-USGS)
W73-11399

AN INVESTIGATION OF FLOODS IN HAWAII THROUGH SEPTEMBER 30, 1972,
Geological Survey, Honolulu, Hawaii. Water Resources Div.
For primary bibliographic entry see Field 02E.
W73-11404

MATHEMATICAL METHODS IN THE THEORY AND PRACTICE OF MOUNTAIN STREAMFLOW COMPUTATION AND FORECASTING (MATEMATICHESKIE METODY V TEORII I PRAKTIKE RASCHETOV I PROGOZOV STOKA GORNYKH REK).
Srednaziatskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Tashkent (USSR).
For primary bibliographic entry see Field 04A.
W73-11406

WATER REQUIREMENTS FOR OPTIMUM CROP YIELD,
Corps of Engineers, West Palm Beach, Fla.
For primary bibliographic entry see Field 03F.
W73-11507

AN INDIVIDUAL APPROACH TO INDEPENDENT COMPUTER SURVEY,
Engineering Surveys Ltd., Weybridge (England).
W. F. Johnston, and G. L. Thornton.
Surv Mapp, Vol 32, No 4, p 479-489, Dec 1972. 3 fig.

Descriptors: Digital computers, "Topographic mapping, Data processing, "Contours, Computer programs, Cross-sections, Mapping, Numerical analysis, Measurement, Volume, Earthworks, Foreign research, "Surveys, Geologic mapping.
Identifiers: "Plotting, Great Britain," "Plotters."

Planning and development of a computer system is described that produces a digital terrain model (DTM) from a series of random points based on field data. The model is used as a data base for the computer to automatically: (1) plot contours at any desired intervals for topographic maps; (2) produce cross sections and longitudinal sections of

existing roads; and (3) compute earthwork quantities. The model consists mainly of a series of points of known elevations and locations. The model is computed from measured points representing the surface. This enables the surveyor to follow normal practices without artificial constrictions. The model is computed in a square grid, the cell size being optimized from the density and distribution of the measured data. Selection and details of the computer hardware and the problems of training computer operators are discussed. Other applications of DTM are: (1) designing new airfields; (2) computing volumes on a routine and regular basis either to control excavations or filling at open pit mines; (3) measuring stockpiles; (4) port development, and (5) geological mapping (USBR).
W73-11512

NUMERICAL STATISTICS IN ENGINEERING GEOLOGY,
McGill Univ., Montreal (Quebec).
For primary bibliographic entry see Field 08G.
W73-11517

COMPUTER PROGRAM SYSTEM FOR AEROTRIANGULATION,
Illinois Univ., Urbana.
K. W. Wong, and G. Elphingstone.
J Surv Mapp Div, Am Soc Civ Eng, Vol 98, No. SU2, p 219-231, Nov 1972. 6 fig, 5 tab, 4 ref, 2 apend.

Descriptors: "Aerial photography," "Photogrammetry," "Computer programs, Mapping, Altitude, Evaluation, Control, Distance.
Identifiers: "Surveying, Triangulation nets, Position finding, Azimuth," "Aerotriangulation, Geodetic surveys, Geodesy."

A total system of highly flexible computer programs developed to meet all computation needs in analytic aerotriangulation is presented. The basic solution is based on simultaneous adjustment of all photogrammetric and geodetic observations. This solution, SAPGO, provides a more rigorous solution for aerotriangulation than the conventional simultaneous solution. All fundamental measurements, such as image coordinates, horizontal angles, distances, and elevations, can be weighted according to the accuracy with which these measurements were made. Independent geodetic measurements may also be used to control aerotriangulation projects over poorly accessible terrains. The component concept has been used to provide several versions of the SAPGO programs so that surveying and mapping engineers, who have little knowledge of the theory of analytical photogrammetry can use them. Several program packages developed are: (1) for processing of small triangulation projects (less than 40 photos), (2) handling unlimited size blocks, and (3) simulation studies. Tests using fictitious data showed that the solution method is accurate and sensitive to variations in weights. (USBR)
W73-11518

RESERVOIR BANK STORAGE,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02H.
W73-11542

SUPPLEMENTATION OF MISSING VALUES IN WATER QUALITY DATA,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05G.
W73-11687

Field 08—ENGINEERING WORKS

Group 8A—Structures

08. ENGINEERING WORKS

8A. Structures

MOBILE AREA WATER TRANSPORTATION STUDY OF MOBILE, BALDWIN AND ESCAMBIA COUNTIES, ALABAMA.

Tippett Abbott McCarthy Stratton, New York.

South Alabama Regional Planning Commission, Mobile, December, 1968. 161 p, 8 fig, 8 maps, 55 tab. HUD Alabama P-32.

Descriptors: *Harbors, *Navigation, *Transportation, Water resources development, Planning, Channel improvement, *Alabama.

Identifiers: *Mobile, *Baldwin County (Ala), *Escambia County (Ala), Economic growth, Industrial development, Waterfronts, Port facilities.

The development of the port of Mobile and the surrounding waterways is seen as an important means to encourage economic growth in southern Alabama. The area's resources can be used for transportation arteries and sources of industrial water supply as well as for recreation and commercial fishing. This program for the phased development of the navigable waters in the Mobile area focuses on two basic issues: the demand of industries for port facilities and waterfront locations and the need for expansion and improvement of the port of Mobile. These issues are dealt with in eight chapters analyzing the existing port economy, inventorying port facilities, forecasting industrial development and water traffic, assessing the need for waterfront land sites, and identifying a three-stage development program. The development program proposes locations for various types of industries and marine facilities and the time of several channel improvements and terminals. (Elfers-North Carolina)

W73-11260

CONTROL OF HAZARDOUS CHEMICAL SPILLS BY PHYSICAL BARRIERS, MSA Research Corp., Evans City, Pa.

For primary bibliographic entry see Field 05G.

W73-11338

LEAST COST METHOD FOR SEWER DESIGN, Camp, Dresser and McKee, Boston, Mass.

For primary bibliographic entry see Field 05G.

W73-11360

TYPICAL LOG-CURVE SHAPES INDICATE FORMATION CHARACTERISTICS, Dresser Industries, Inc., Houston, Tex.

W. R. Matthews.

Oil and Gas Journal, Vol 69, No 49, p 66-72, December 6, 1971.

Descriptors: Logging (Recording), *Electrical well logging, Resistivity, Gamma rays, *Lithologic logs, Sandstone, Shales, Salinity wells, Drilling, Density.

Identifiers: *Spontaneous potential, Rock salt.

A look at log curve shapes, or trends, is a good place to begin the study of formation identification. The SF portion of the electric log can be used for: distinguishing sands from shales, for determining water salinity in sand, prediction of oil, gas, or water production from a sand, and estimation of mud-weight requirements. The method of establishing shale and sand lines is discussed. Methods of determining shale values—averages of 10 to 50 feet intervals, and maximum values, are shown. Each technique has advantages and disadvantages. Other types of logs discussed which are useful in formation evaluation are the density log,

the gamma-ray log, and the resistivity and conductivity logs. In the identification of rock salt, the density log is especially useful as the bulk density of salt is usually below 2.0 g/cc. Oil muds affect the resistivity and conductivity values on a resistivity-type log. (Smith-NWWA)

W73-11456

Descriptors: Concretes, Concrete construction, Concrete finishing, *Concrete structures, Acids, Florida, Sewers, Sewerage, Materials, Corrosion, *Repairing, Mortar, *Corrosion control, *Deterioration.

Identifiers: Wet wells, Sandblasting.

Sewer gases producing corrosive acids had severely deteriorated the concrete surfaces in wet wells of the St. Petersburg Beach, Florida sewer system. In some cases the reinforcing steel was fully exposed. Various materials used for repair had in most cases proved unsatisfactory. Some would lose their bonding effect in less than six months, while others reacted to the corrosive atmosphere within two years. The latest resurfacing material, a micro-cement, has promising indications of the desired properties for permanent repair at reasonable cost. Installation involved shutting off the system in the section to be repaired, sandblasting all deteriorated surfaces, removing loose, contaminated concrete, flushing all surfaces with clean water, and applying the mortar material to the prepared surfaces. The material set very quickly; six weeks after application, inspection revealed no hairline or shrinkage cracks even in areas which needed substantial build-up. (Smith-NWWA)

W73-11462

HOW TO CUT DRILLING COSTS BY REDUCING NONDRILLING TIME, Field Drilling Co., San Antonio, Tex.

J. P. Kidd.

Oil and Gas Journal, Vol 70, No 36, p 91-93, September 4, 1972. 1 fig.

Descriptors: Drilling, *Drilling equipment, Costs, *Cost analysis, Cost comparisons, Oil industry, Wells, Boreholes, Well casing, Drill holes, *Efficiencies, Repairing.

Identifiers: Drill rigs, Trip time, Contracting.

Virtually all efforts of drilling technologists have to date gone into maximizing the feet drilled per hour and the hours drilled per bit, while minimizing the number of bits and the total rotating hours. It is pointed out, however, that it is generally easier and cheaper to save additional rig time by giving special attention to making connections, handling drill collars, tripping, and other nondrilling operations. Assuming it takes 200 days to drill and complete a large midcontinent well, total well costs excluding permanent well equipment would run \$4,000/day or higher. So, the cost of losing only 1 minute each hour could total \$13,300 during the drilling of one well. Key areas in reducing costs by improving nondrilling operations include time required for connections, trips, setting surface casing and waiting on cement, deviation surveys, and rig service. (Smith-NWWA)

W73-11460

ABNORMAL PRESSURES IN DEEP WELLS OF SOUTHWESTERN LOUISIANA, Tulsa Univ., Okla.

For primary bibliographic entry see Field 08E.

W73-11464

OIL FIELD TECHNIQUES USED TO INCREASE FLOW IN COMMUNITY WATER WELL, T. J. Barnhart.

Water Well Journal, Vol 21, No 1, p 24, January 1966.

Descriptors: Wells, *Water wells, Hydraulics, Limestones, Aquifer management, *Water yield improvement, Groundwater, Groundwater availability, Boreholes, *Hydraulic machinery.

Identifiers: Well development, *Well stimulation, *Hydraulic fracturing, Packers (Borehole), Acidizing (Wells).

Hydraulic fracturing is a method used in oil and gas wells to increase rate of production. Various combinations of fluids and propping sands are injected into the producing zone at sufficient pressure to fracture or break the formation down. The sand acts as a propping agent for the fractures which serve as zones of higher conductivity for the produced fluids. In the example given, a well's yield was increased from 22 to 110 gpm using gelled fresh water and sand to fracture the producing zone. A packer was used to divert the fracturing fluids to the desired portion of the open hole at approximately 205 feet in the Niagara Lime aquifer. 600 psi was necessary to break the formation down; additional fluid was pumped into the formation at 400 psi. The packer was then unloaded and moved uphole approximately 20 feet where the same procedure was followed. (Campbell-NWWA)

W73-11465

BOREHOLES—CONSTRUCTION AND USE: FINAL REPORT OF RESEARCH PANEL, NO. 9, Institution of Water Engineers, London (England).

Institution of Water Engineers Journal, Vol 23, No 6, p 369-381, June 1969. 3 tab.

Descriptors: Wells, Water wells, *Observation wells, Construction, Construction costs, *Boreholes, *Aquifer characteristics, Rock properties, Sampling, *Water sampling, Water supply development, Transmissivity, Storage coefficient, Porosity, Permeability.

Ident
bore

An o
small
strat
squid
meas
the g
of th
sampl
hydr
loggi
obse
whic
drill
includ
ward
dard
head
ensur
minim
W73

OPT
WE
R. R.
Wat
Janu

Descri
Well
*Eco
cient
Ident

A lo
timu
with
qua
site
qua
A m
eval
resou
drain
desc
descri
imp
stre
at a
in th
obse
req
wat
will
NW
W73

CAT
PRA
Cor
K. C.
Wat
416-

Des
*Ca
Mag
Acid
Ident

The
som
wat
elec
exte
by
des
res
show
detec

ENGINEERING WORKS—Field 08

Structures—Group 8A

Identifiers: Strata (Geologic), *Observation boreholes.

An observation borehole is a boring, generally of small diameter, which is drilled into underground strata to penetrate either partially or fully an aquifer or aquifers and thereby provide a means of measuring the physical and chemical properties of the ground water and the physical characteristics of the aquifer. Water level measurement, water sampling for analysis, rock sampling, and other hydrogeological parameters measured by borehole logging are discussed. The diameter and depth of observation boreholes depend on various factors which are listed. Construction methods used to drill boreholes and the costs of each are explained, including auger, jetting, percussion, and both forward and reverse circulation rotary methods. Standardization of materials, fittings, recorders, and headworks for boreholes is recommended both to ensure high quality of construction and to minimize their cost. (Smith-NWWA) W73-11466

OPTIMUM HOLE DIAMETER FOR WATER WELLS.

R. R. Aitkin, and E. L. Alexander.
Water Well Journal, Vol 21, No 1, p 18-19, 22, 65,
January 1967. 3 fig.

Descriptors: Wells, Water wells, *Optimization, Well casings, Well screens, *Pump testing, *Economics, Aquifers, Drawdown, Aquifer testing, Water supply development, Storage coefficient, Water levels.

Identifiers: *Well diameters.

A logical approach to the determination of optimum hole diameter for a water well must start with a hydrogeological study to ascertain: (1) the quantity and quality of water available at a given site where the need for water exists; (2) the location of a site that will yield water of sufficient quantity and quality to satisfy an anticipated need. A meaningful accumulation of data for the proper evaluation of a given area in terms of water resource development should include weather, drainage, slope of rock bed, formation names, description of materials, and hydrologic information. In determining optimum hole diameter, the importance of a properly conducted aquifer test is stressed. Common procedure is to pump the well at a constant rate while measuring the water level in the pumping well, and if possible, in at least two observation holes. In determining well size, a decision must be made as to the diameter of casing required to accommodate the air line tubes, special water level measuring devices and the pump that will produce the needed quantity of water. (Smith-NWWA) W73-11468

CATHODIC PROTECTION—THEORY AND PRACTICE IN THE WATER INDUSTRY,
Corrosion Engineers Ltd., Alresford, (England).
K. G. C. Berkeley.
Water and Water Engineering, Vol 72, No 872, p
416-422, October, 1968. 8 fig, 3 tab, 7 ref.

Descriptors: Corrosion, Corrosion control, *Cathodic protection, Electrochemistry, Anodes, Magnesium, Electric currents, *Design criteria, Acidity, Alkaline soils, Acid soils, Soil properties. Identifiers: *Galvanic corrosion, Electrical circuits.

The history, causes and the remedial approach to some of the corrosion problems affecting the water industry are outlined. Phenomena leading to electrochemical corrosion are described, and the extent to which cathodic protection can be utilized by those having responsibility for planning and design is indicated, in order to enable those responsible to ascertain at what stage action should be taken. The four basic causes of metallic deterioration—galvanic corrosion, differential

aeration, stray current corrosion, and bacterial corrosion—are briefly discussed. Cathodic protection is not an absolute solution but one which can be extremely successful. The overall cost of protection must obviously vary, but a reasonable figure is some 0.5 to 5 per cent of the cost of a structure covering a 20 year life. (Smith-NWWA) W73-11472

ESTIMATING WELL COSTS.

Industrial Water Engineering, Vol 7, No 4, p 30-32, April, 1970. 4 fig, 1 tab.

Descriptors: Wells, *Water wells, *Cost analysis, Shallow wells, Well screens, Well casings, Pumps, Unconsolidated aquifers, Aquifers, Boreholes, Materials, *Cost comparisons, *Graphical analysis.

Identifiers: Well yield, Well diameter.

Well-cost data were divided into three categories, namely sand and gravel wells, shallow bedrock wells, and deep sandstone wells. Naturally-developed and artificially gravel-packed wells finished in sand and gravel were considered separately. Wells tapping Pennsylvanian, Mississippian and Devonian sandstone or limestone, and those tapping the Silurian or upper Ordovician dolomite aquifers were combined in the shallow bedrock grouping. Those wells penetrating the Cambrian-Ordovician or Mount Simon rocks were considered as deep sandstone wells. Analysis of data, taken from an Illinois State Water Survey Circular, showed that the cost of wells is directly related to depth. Further studies showed that wells are generally constructed of a given diameter in order to provide sufficient minimum clearance for a pump with a specified capacity equal to the desired yield of the well. In recent years there has been a trend toward using casing at least two nominal diameters larger than the minimum required to allow installation of the pump. (Smith-NWWA) W73-11476

THE BIGGEST ARTESIAN WELL IN THE WORLD,

Artesia Chamber of Commerce, N. Mex.
B. Koonce.

The Farm Quarterly, Vol 20, No 2, p 60, 98, 99,
Summer 1965. 3 fig.

Descriptors: Wells, *Water wells, Limestones, Drilling, Carbonates, Aquifers, Artesian aquifers, *Artesian wells, Well casing, Valves, New Mexico, *Irrigation wells, Clays, Grouting.

Identifiers: Abandonment (Wells), *Plugging (Wells).

Details of the drilling of a record artesian well, 840 feet deep with a yield of 9,280 gpm are given. Named the Great Oasis Well, it is located near Roswell, New Mexico, and was drilled in 1931 on the property of J. H. Gifford by Myron Bruning. Near the proposed well site was an old eight inch well which had run an uncontrolled stream for years. Using dense native red clay and cottonseed hulls, Bruning made a mixture which, when pumped into the well bore, shut the flow of water off and sealed the well. Then attention was turned to drilling the big well. 710 feet of 18 inch hole was drilled into which a 13 inch casing was set and grouted in with the red clay mixture. A 12 inch bit was let down and drilled through the San Andres limestone to the total depth of 840 feet. Sixty feet of 13 inch well casing was attached to a gate valve and hoisted onto the well head; the casing was detached from the wellhead and the gate valve closed. For display purposes, a reduced which held the outlet to four inches was attached, spraying the water 75 feet into the air. (Smith-NWWA) W73-11481

A PROBABILISTIC APPROACH TO MAXIMUM COLUMN STRENGTH,

Lehigh Univ., Bethlehem, Pa.

R. Bjorhovde.

Paper, American Society of Civil Engineers, Spec Conf Safety Reliab Metal Struct, Pittsburgh, Pa., Nov 1972. 30 p, 9 fig, 16 ref.

Descriptors: *Columns, Deflection, *Structural analysis, *Structural behavior, Structural members, Structural shapes, Structural design, *Probability theory, Performance, Steel, Investigations, Compressive strength, Loads (Forces), Bibliographies.

Identifiers: *Camber, Deterministic model, Supports, Vertical loads, Flexural strength, Residual stress, Statistical analysis.

A probabilistic method is presented for determining maximum strength of centrally loaded, initially curved, pinned-end, prismatic steel columns. In calculating maximum strength, the variation of relevant strength parameters is considered explicitly. This method circumvents several of the steps necessary in the familiar deterministic approach, and permits direct analysis of separate and joint effects of the variables. A structure exhibiting a random nonlinear behavior, for which the basic relationships are expressed as incremental, iterative equations, is treated within the context of probability theory. Random variation of the strength of a particular column depends on the random variation of the initial out-of-straightness. Random variation of the yield stress has a small effect on the column strength but increases with increasing yield stress and range of variation. Random variation of the residual stresses about their mean, and of cross-sectional properties, do not contribute significantly to random variation of maximum column strength. A brief description of the deterministic method for analysis of maximum column strength is also given. (USBR) W73-11516

DESIGNING TO PREVENT BRITTLE FRACTURES IN BRIDGES,

Kansas Univ., Lawrence.

For primary bibliographic entry see Field 08G. W73-11525

DETERMINING THE STRENGTH OF CORRODED PIPE,

Texas Eastern Transmission Corp., Shreveport, La.

For primary bibliographic entry see Field 08G. W73-11527

HYDRAULIC DESIGN OF STILLING BASIN FOR PIPE OR CHANNEL OUTLETS,

Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

For primary bibliographic entry see Field 08B. W73-11533

STUDY FOR IMPROVEMENT OF MONTE SANO BAYOU FROM AIRLINE HIGHWAY TO MISSISSIPPI RIVER EAST BRANCH ROUGE PARISH, LOUISIANA.

Brown and Butler, Baton Rouge, La.

Mayor and Council City of Baton Rouge and Parish of East Baton Rouge, Louisiana, May 1969. 82 p, 49 fig, 2 tab.

Descriptors: *Flood control, *Channel improvement, *Hydraulic structures, Hydraulics, Culverts, Head loss, Design flow, Louisiana, Channel flow, Canal linings, Concrete-lined canals.

Identifiers: *Monte Sano Bayou (Louisiana).

Improvement of the Monte Sano Bayou in the parish of East Baton Rouge, Louisiana was studied to control flooding problems. The watershed

Field 08—ENGINEERING WORKS

Group 8A—Structures

covers about 6,750 acres, and is primarily industrial but also contains heavily populated urban areas and agricultural lands. Design criteria were specified for the project, including a stage elevation of 36.5 at the Mississippi River outlet and a maximum elevation of 47.0 at Airline Highway, approximately 6,000 feet upstream. The design storm data of the City-Parish Department of Public Works was also used. It was found that the major cause of the flooding was from deficiencies in waterway openings of crossings, of roadways and railroads. Submerged pipe crossings also exist, but these were found to have only a small effect on the water level in the bayou. Improvements studied included realignment of the bayou, improvement of the waterway openings, and channel and bank improvement. Major realignment was found not to be feasible because of the cost and poor soil conditions in the area of the proposed realignment. It was recommended that the existing hydraulic deficiencies be corrected and that some channel improvement be done, consisting of bed widening and concrete channelization. Total project cost will be about 1.5 million dollars. (Poertner)
W73-11682

8B. Hydraulics

COASTAL DYNAMICS ALONG MUSTANG ISLAND, TEXAS,
Western Michigan Univ., Kalamazoo.
For primary bibliographic entry see Field 02L.
W73-11081

EFFECTS OF SUBMERGED SILLS IN THE ST. CLAIR RIVER,
Army Engineer Waterways Experiment Station,
Vicksburg, Miss.
J. J. Franco, and J. E. Glover.
Available from NTIS, Springfield, Va 22151 AD-748 393, Price \$3.00 printed copy; \$0.95 microfiche. Technical Report H-72-4, August 1972. 49 p, 20 plate, 7 photo, 3 tab.

Descriptors: *Water control, *Water levels, *Lake Huron, *Navigation, *Model studies, inflow, Rivers, Engineering structures, Environmental effects, Sedimentation, Analytical techniques, Planning, Feasibility studies, Evaluation.
Identifiers: *Submerged sills, *Lake St. Clair River.

The St. Clair River connects Lake Huron and Lake St. Clair. The river, about 40 miles long, is a vital link in the Great Lakes inland navigation system in north central United States. Low lake level experienced in Lake Huron during the early 1960's had a significant detrimental economic impact on the area. In order to increase the water level in Lake Huron, plans for using submerged sills at the head of St. Clair River were proposed. A fixed-bed, 1:60-scale model that reproduced approximately 2.8 miles of the St. Clair River and a small section of the lower end of Lake Huron was used to study the effects of the sills. With the sill arrangements developed, water levels in Lake Huron could be raised by up to 0.75 ft without adversely affecting navigation conditions. A type of sill that would facilitate construction and reduce construction cost could be used without any significant loss in effectiveness. Shoaling along the Canadian shore can be attributed to the movement of sediment into that side of the river, the natural tendency for shoaling on the convex side of a river bend, and the effects of the eddy currents. Sills would tend to reduce the size of the eddy and the tendency for shoaling. Some deposition of sediment could occur along the left ends of some of the sills that would tend to reduce their deposition would tend to be small. (Woodard-USGS)
W73-11089

FINITE ELEMENT SOLUTION FOR GENERAL FLUID MOTION,
Alaska Univ., College Inst. of Water Resources.
G. L. Guymon.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 99, No HY6, Paper 9789, p 913-919, June 1973. 1 fig, 11 ref.

Descriptors: *Finite element analysis, *Numerical analysis, *Flow, Hydrodynamics, Equations, Groundwater movement, Open channel flow, Hydraulics, Fluid mechanics.
Identifiers: *Navier-Stokes equations.

General hydrodynamic equations of the same form as the Navier-Stokes and continuity equations are numerically solved by a variational method based on a quasi-linear variational principle. The finite element decomposition results in simple linear matrix system that is readily solved by standard first order numerical methods. A pseudo-iterative procedure is used to accommodate the basic non-linearity of the equations of motion. (Knapp-USGS)
W73-11091

A CASE HISTORY OF SANTA CRUZ HARBOR, CALIFORNIA,
California Univ., Berkeley Coll. of Engineering.
J. T. Moore.

Available from NTIS, Springfield, Va. 22151 as AD-751 770 Price \$3.00 printed copy; 95 cents microfiche. Hydraulic Engineering Laboratory Report HEL-24-14, June 1972. 25 fig, 15 ref.

Descriptors: *Harbors, *Shoals, *Navigation, *California, *Littoral drift, Environmental effects, Construction, Jetties, Boats, Recreation facilities, Reviews, Planning, Coasts, Waves (Water), Sediment transport, Sediment distribution, Ocean currents, Shore protection, Dredging.
Identifiers: *Santa Cruz Harbor (Calif.)
W73-11365

Santa Cruz Harbor is a smallcraft harbor located about 80 miles south of San Francisco, California. The harbor was completed in 1964 to meet the needs of a growing boat slip demand and provide shelter from storms. The entrance channel to the harbor has since experienced severe shoaling problems that have greatly reduced the intended year-round use of the facilities. The Santa Cruz Harbor project and maintenance problems that have developed since construction are reviewed. After completion of the jetties in May 1963, approximately 600,000 cubic yards of sand accumulated on the upcoast beach in a 2-year period. From 1965 to 1971 the shoaling became increasingly severe. The increase in shoaling can be linked to the progressive buildup of the upcoast beach. The west jetty has caused a gradual accumulation of sand in comparison with the initial conditions prior to construction. The shoaling of the entrance channel occurs within a short period of time during the storm season and particularly in late winter and early spring. A proposed program of dredging would over dredge the entrance channel in November-December to provide for 200,000 cubic yards of storage as preparation for the winter storm season. Following the storm season the dredge would again restore the channel in April-May for recreational summer boating. (Woodard-USGS)
W73-11092

PROTECTION AND CONTROL OF THE SALT WATER SHORE AREA,
Rhode Island Statewide Planning Program, Providence.
For primary bibliographic entry see Field 06E.
W73-11114

HYDRAULICS OF SHALLOW FLOWS OVER STABLE ERODED SAND SURFACES DEFINED BY AREA SPECTRA,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 02A.
W73-11192

DISCRETE GRADIENT OPTIMIZATION OF WATER SYSTEMS,
Medical Univ. of South Carolina, Charleston Dept. of Biometry.
C. F. Lam.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 99, No HY6, Proceedings paper 9804, p 863-872, June, 1973. 4 fig, 1 tab, 8 ref.

Descriptors: *Water, *Distribution systems, *Optimization, *Pipes, *Design, Hydraulics, Pipelines, Piping systems (Mechanical), Size, Head loss, Flow, Computers, Systems analysis, Mathematical models, Water supply.
Identifiers: *Gradient techniques.

The cost of a water system depends on the type and size of pipes used; the size of pipes is discrete. With present optimization techniques, diameter of pipes is assumed to be continuous; at the end of the optimization process, the diameters of pipes are then rounded to the nearest commercially available size—this will give an approximate minimum at best, and possibly a nonfeasible solution. A discrete optimization technique is presented to treat pipe diameter as a discrete variable. It has been applied to a fairly large water transmission system with good results. This technique can be used to design a completely new system as well as an expanding one; other pipe networks, such as an oil pipeline and an aircraft fuel system, also can be designed by this method. (Bell-Cornell)
W73-11365

PROBLEM OF THE INFLUENCE OF SHAPE OF CHANNEL CROSS SECTION ON VELOCITY DISTRIBUTION IN A UNIFORM TURBULENT FLOW (K VOPROSU O VLIYANII FORMY SECHENIYA RUSLA NA RASPREDelenIYE SKOROSTEY V RAVNOMERNOm TURBuLENTNOM POTOKE),
Dnepropetrovskii Khimiko-Tekhnologicheskii Institut, USSR.
S. A. L'vov.
Meteorologiya i Gidrologiya, No 1, p 68-78, January 1973. 2 fig, 2 tab, 9 ref.

Descriptors: *Channel morphology, *Shape, *Cross-sections, *Velocity, *Flow, Turbulent flow, Uniform flow, Profiles, Surfaces, Graded, Depth, Width, Roughness (Hydraulic), Equations.
Identifiers: USSR.

Theory and techniques for calculation of surface velocities and for approximate calculation of mean vertical velocity distribution in different flows with a steady uniform turbulent motion are discussed. The calculations are based on a coefficient suggested for describing the relative influence of shape of channel on center verticals of certain symmetrical cross sections. (Josephson-USGS)
W73-11408

NEW BITS CAN DRILL MORE HOLE,
L. C. Rogers.
Oil and Gas Journal, Vol 65, No 46, p 118-121, November 13, 1967. 10 fig.

Descriptors: Drilling, *Rotary drilling, *Drilling equipment, Oil industry, Core drilling, Drilling fluids, Technology, Jets, Mechanical equipment, *Design.

Identifiers: *Drill bits, Diamond drilling, *Tungsten carbide inserts, Insert bits, Turbodrills.

ENGINEERING WORKS—Field 08

Hydraulics—Group 8B

Tungsten-carbide insert bits, first developed for drilling hard, brittle rocks are being extended to softer formations previously reserved for milled-tooth bits. Special designs such as chisel-point inserts have made them practical for such applications. Sealed-bearing designs have improved because of broader research and development; this translates into longer bit life. A line of bits designed to combat balling—the extended-nozzle, the four-jet, and the slant-jet bits—are discussed. A filter drill collar designed to flush and lubricate bit bearings is also discussed. Diamond-bit manufacturers have taken a two-pronged approach to ways of increasing penetration rates with diamond bits and core heads: (1) Better stabilization to provide a continuous contact between the diamonds and the bottom of the hole; (2) Ways to improve the cuttings-removal rate so new surface can be presented to the bit, or each diamond, with each revolution. (Campbell-NWWA)
W73-11457

NEW DOWN-HOLE TOOLS IMPROVE DRILLING,

L. C. Rogers.
Oil and Gas Journal, Vol 65, No 47, p 188-196, November 20, 1967. 5 fig, 1 tab, 2 ref.

Descriptors: Drilling, *Rotary drilling, *Drilling equipment, Drill holes, Oil industry, Vibrations, Wells, Deep wells, *Technology.
Identifiers: Stabilizers, Hole deviation, Vibration dampeners, Drill bits, Innovations, Drill pipe.

Some of the latest developments in tools and methods to simplify deviation control and to reduce drill-stem failures include: New stabilizer assemblies which promote longer bit life and prevent sharp "doglegs"; a novel "straight-hole" tool which decreases hole angle without sacrificing weight on bit; heavy-weight drill pipe which (a) replaces some of the hard-to-handle collars in directional work, and (b) stiffens the critical transition zone between collar and drill pipe; vibration dampeners which take the "bounce" out of drilling—regardless of borehole temperature or oil content of the drilling fluid. Relaxation of total-deviation requirements has been responsible for great improvements in drilling rate. Several substitutes for the square collar in preventing hole deviation are now appearing. Several advantages to using heavyweight drill pipe in certain applications are discussed. Drillers are just starting to appreciate the advantages of vibration-dampening tools and several new designs just put on the market reflect renewed interest in this product. (Smith-NWWA)
W73-11458

ROTARY RIG DUE FOR FACE-LIFTING,

L. C. Rogers.
Oil and Gas Journal, Vol 65, No 48, p 75-78, 84, November 27, 1967. 7 fig, 3 ref.

Descriptors: Drilling, *Rotary drilling, *Drilling equipment, Drilling fluids, *Automation, Alternating currents, Direct currents, Generators, *Turbines, Pumps, Oil industry, Offshore platforms, Computers, Technology.
Identifiers: Engines, Internal-combustion engines, Reciprocating engines.

Changes which are occurring and will occur shortly on a rotary rig design include: Turbines are making a bid to replace reciprocating engines as prime movers; single-acting, multiple pumps are giving the duplex-slush pump some strong competition; a rectified a-c arrangement is being designed which would do away with d-c generators on electric rigs; efforts to automate the rotary rig throughout are being made; computerization is being considered; entirely new types of rigs are being evaluated. Interest in technological innovations is being stimulated by demands for more productivity to curb rising costs and to solve labor problems. The gas turbine's advantages of light

weight, small size, quick starts, ease of maintenance, and ability to run on a wide range of fuels make it especially suited to drill rig prime mover application. Compact design, light weight, smooth discharge flow, wide choice of volumes and pressures, low fluid-end replacement costs, and ease of maintenance are the main attractions of the single-acting, half-piston pump for mud service on a rig. (Campbell-NWWA)
W73-11459

HOW TO CUT DRILLING COSTS BY REDUCING NONDREDGING TIME,

Field Drilling Co., San Antonio, Tex.
For primary bibliographic entry see Field 08A.
W73-11460

SALINITY CONTROL ON A BOREHOLE SOURCE IN BUNTER SANDSTONE,

East Shropshire Water Board (England).
For primary bibliographic entry see Field 04B.
W73-11469

OPERATION AND CAPABILITY OF THE BECKER HAMMER DRILL,

Becker Drilling Ltd., Calgary (Alberta).
For primary bibliographic entry see Field 08C.
W73-11470

RADIAL COLLECTOR WELL SOLVES WATER SUPPLY PROBLEM,

Bonestroo, Rosene, Anderlik and Associates, Inc., Mankato, Minn.
R. W. Rosene.
Consulting Engineer, Vol 40, No 2, p 62-64, February, 1973. 3 fig.

Descriptors: Wells, Water wells, *Water supply development, Water consumption, *Water demand, Shallow wells, *Infiltration galleries, Unconsolidated aquifers, Minnesota, Caissons, Construction costs.
Identifiers: Wellfields, *Radial collector wells, Horizontal wells, Mankato (Minn.).

Details of a radial collector well system engineered for the city of Mankato, Minnesota, are given. With projected large increases in water demand caused by an increasing population and industrial growth, one of the city's critical problems was the immediate need to increase its water supply by at least 3 million gallons per day. Construction cost estimates favored the use of vertical well system; however, certain features of the radial collector system, including its ability to be expanded at less cost, and features of operation and maintenance made it more desirable than the vertical well system. Plans for the collector well included a 16 ft. inside diameter concrete caisson with 24 in. thick wall. The caisson was to be sunk 55 ft. to bedrock and to extend 15 ft. above the flood plain. Five horizontal laterals were to be constructed with ports added for the future addition of five more. At completion of the well, pumping tests indicated a capacity of slightly more than 5 million gallons per day from the present laterals and a theoretical recharge capability of approximately 9 million gallons per day at that location without exceeding reasonable drawdown limitations. (Campbell-NWWA)
W73-11480

Changes which are occurring and will occur shortly on a rotary rig design include: Turbines are making a bid to replace reciprocating engines as prime movers; single-acting, multiple pumps are giving the duplex-slush pump some strong competition; a rectified a-c arrangement is being designed which would do away with d-c generators on electric rigs; efforts to automate the rotary rig throughout are being made; computerization is being considered; entirely new types of rigs are being evaluated. Interest in technological innovations is being stimulated by demands for more productivity to curb rising costs and to solve labor problems. The gas turbine's advantages of light

weight, small size, quick starts, ease of maintenance, and ability to run on a wide range of fuels make it especially suited to drill rig prime mover application. Compact design, light weight, smooth discharge flow, wide choice of volumes and pressures, low fluid-end replacement costs, and ease of maintenance are the main attractions of the single-acting, half-piston pump for mud service on a rig. (Campbell-NWWA)
W73-11459

ESTIMATING WELL COSTS.

For primary bibliographic entry see Field 08A.
W73-11476

CATHODIC PROTECTION—THE ANSWER TO CORROSION PREVENTION OF UNDERGROUND STRUCTURES,

Hinchman Co., Detroit, Mich.
For primary bibliographic entry see Field 08G.
W73-11477

PROCEDURE IMPROVED FOR DETERMINING CORROSION RATE BY WEIGHT LOSS,

Naval Civil Engineering Lab., Port Hueneme, Calif.
For primary bibliographic entry see Field 08G.
W73-11478

DESIGN AND INSTALLATION OF DEEP ANODE GROUNDBEDS,

Cathodic Protection Service, Tulsa, Okla.

R. W. Stephens.
In: Proceedings, University of Oklahoma Corrosion Control Course, Houston, Texas, 1970, p 31/1-31/5. (1970). 3 fig.

Descriptors: Boreholes, Corrosion, *Corrosion control, *Anodes, *Installation, Installation costs, Drilling, Rotary drilling, Chlorine, Iron, Electrical equipment, Electric currents, Electrochemistry, Design, *Design criteria.
Identifiers: Niobium, *Deep anode groundbeds, Platinum, Tantalum.

A deep grounded is defined as a grounded in which one or more anodes are installed vertically in a drilled hole at a depth of 50 feet or more. Generally, an 8 or 10 inch diameter hole, drilled to a depth of 100 to 400 feet is the most widely used configuration. Advantages and disadvantages of the deep anode groundbed system are given, when compared with conventional groundbeds. Types of deep groundbed installations are covered, including the standard installation and variations; one has the anodes strapped to a support pipe and a vent pipe and the whole assembly is lowered down the hole. In another type a steel pipe is used as an anode. Some "exotic" deep groundbeds made of platinum wire wrapped on short sections of Teflon tubing, and platinized or platinum clad titanium, tantalum, or niobium anodes are discussed. Material selection for a deep groundbed installation is more critical than for a conventional bed. Different materials for different conditions are discussed, and an overview of deep anode groundbed installation is given. (Campbell-NWWA)
W73-11480

THE BIGGEST ARTESIAN WELL IN THE WORLD,

Artesia Chamber of Commerce, N. Mex.
For primary bibliographic entry see Field 08A.
W73-11481

REHABILITATION OF IRRIGATION SYSTEMS FOR SALINITY CONTROL,

Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 03F.
W73-11509

CROP RESPONSE TO TRICKLE AND SUBSURFACE IRRIGATION,

Texas A and M Univ., College Station.
For primary bibliographic entry see Field 03F.
W73-11513

WATER INFILTRATION UNDER CENTER-PIVOT SPRINKLERS,

Nebraska Univ., Lincoln.
J. W. Addink, and D. L. Miles.
Paper 72-725, 1972 Annual Meeting American Society of Agricultural Engineers, Chicago, Ill., Dec 1972. 18 p, 8 fig, 3 tab, 9 ref.

Field 08—ENGINEERING WORKS

Group 8B—Hydraulics

Descriptors: *Irrigation engineering, *Infiltration rate, Ponding, *Irrigation efficiency, *Sprinkler irrigation, Soil water movement, Erosion, Infiltration, Irrigation practices, Irrigation systems, Laboratory tests, Moisture content, Nozzles, Rates of application, Soils, Surface irrigation, Surface runoff.

Self-propelled, continuously moving center-pivot sprinkler laterals have become popular because of low initial cost and adaptability for use on rolling, sand soils. Certain characteristics of the center-pivot sprinklers, however, result in substantial runoff at the outer part of the lateral, reducing water-use efficiency and causing decreased crop yields. Laboratory infiltration tests were conducted using 3 simulated center-pivot application-rate patterns to determine which causes the least runoff. One symmetrical and 2 nonsymmetrical patterns were tested on 3 soils—sandy clay loam, loam, and clay loam. The symmetrical pattern was similar to a pattern existing near the outer end of many center-pivot systems in the field; the nonsymmetrical application patterns were humped toward the front. Conclusions are: (1) nonsymmetrical application-rate patterns can potentially reduce runoff under center-pivots by 11% or more, (2) the percent of runoff reduction depends on the shape of the pattern and soil type, and (3) runoff under a nonsymmetrical pattern may increase if the peak application rate is too high or the time length (wetted width) is too short (USBR). W73-11514

HYDRAULIC DESIGN OF STILLING BASIN FOR PIPE OR CHANNEL OUTLETS, Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

G. L. Beichley.

Available from GPO, Washington, D C 20402. Price \$0.45. Research Report No 24 (A Water Resources Technical Publication), 1971. 27 p, 17 fig, 1 tab, 1 ref.

Descriptors: *Settling basins, *Sedimentation, *Hydraulic models, Energy dissipation, Hydraulic structures, Design criteria, Testing procedures, Open channels, Pipe flow, Velocity, Baffles, Trash racks, Channel morphology. Identifiers: Franklin Canal (Tex).

High-energy forces in flowing or falling water must be contained or dissipated to prevent damaging scour or erosion of downstream channels. Various means for energy dissipation are employed at hydraulic installations. Stilling basins are among the most common. Ten types, I through X, are used by the Bureau of Reclamation. Development of the Type VI short impact-type basin originated with a need for some 50 or more stilling structures on a single irrigation project. Model studies on 1.6- and 2.4-ft-wide (48.76 and 73.15 cm) Type VI stilling basins were conducted to modify existing standard design procedures. Investigations were concerned with: basin entrance flow conditions including type of entrance, slope, velocity, and Froude number; basin dimensions in relation to the basin width; basin width in relation to Froude number; and riprap size and location. Performance was evaluated in terms of energy dissipation and prototype operation. An optimum tailwater, and alternate end sill design, methods of preventing clogging of the basin, and means for automatic removal of sediment from the basin are suggested. (Woodard-USGS) W73-11533

ICE FORCES ON VERTICAL PILES, Cold Regions Research and Engineering Lab., Hanover, N.H.

D. E. Nevel, R. E. Perham, and G. B. Hogue. Available from NTIS, Springfield, Va 22151 as AD-750 358 Price \$3.00 printed copy; \$0.95 microfiche. Report, 1972. 10 p, 8 fig, 1 tab, 16 ref.

Descriptors: *Piles (Foundations), *Design criteria, *Ice loads, *Surface waters, Engineering structures, Stress, Ice, Winds, Currents (Water), Pressure, Analytical techniques, Testing procedures. Identifiers: Vertical piles, Ice force.

The force that floating ice sheets can exert on vertical piles is important to the design of both military and civilian structures. Present design codes call for 400 psi as the crushing strength of ice without regard to the influencing factors and their variation. The forces which drive the ice into the structure can be water currents, wind, or thermal expansion. These driving forces may be large enough to cause the ice to fail at or near the structure. The purpose of this research was to define this limiting force level and gain a better understanding of the failure process in the ice. The most important result is the identification of the different modes of failure. The failure mode has a pronounced influence on the peak nominal stress. Although the general trends observed should extend to full scale, the specific peak nominal stresses may not. (Woodard-USGS) W73-11538

ANALYSIS OF LAKE ERIE WAVE PRESSURE DATA, Northern Illinois Univ., De Kalb. Dept. of Geography.

A. L. Cole.

Available from NTIS, Springfield, Va 22151 as AD-753 960 Price \$3.00 printed copy; \$0.95 microfiche. Final Report (NIU Project 54586), July 1972. 54 p, 24 fig, 6 tab, 4 ref. USAE Contract DACW 35-70-C-0015.

Descriptors: *Waves (Water), *Breakwaters, *Lake Erie, Hydraulic models, Design criteria, Shore protection, Engineering structure, Pressure, Data collections, Correlation analysis, Evaluation. Identifiers: Wave pressure data (Breakwaters), Wave heights, Pressure profiles.

Measured wave heights, wave periods, mean water level increases, and depths of water at a breakwater on Lake Erie at Lorain, Ohio, were used to compute pressure profiles on the breakwater during nonbreaking wave reflections. These computed pressure profiles were evaluated with wave pressure measurements taken concurrently. The rather close agreement between the experimental pressure profiles and the Sainflou predictions indicate that Sainflou's theory can be used for breakwater design purposes in the Great Lakes. The apparent greater wave pressure at stillwater level than predicted by Sainflou could be adjusted empirically or could be absorbed by a reasonable safety factor. The simplicity of the Minikin formulation and its relatively close fit to the experimental data could make it a choice for design purposes. From observations of damage to life preserver supports on the Lorain breakwater and damage to the original instrument shelter used in 1968, it seems that impact damage due to logs and other debris in the water must be an important consideration in the design of any breakwater. The material of a breakwater must be able to withstand the impact of a 2- or 3-foot diameter log slamming into it during a storm situation. The rubble-filled and concrete-topped steel caissons used at Lorain showed no log damage and apparently are quite satisfactory. (Woodard-USGS) W73-11548

SIMULTANEOUS, MULTIPLE-LEVEL RELEASE FROM STRATIFIED RESERVOIRS, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.

J. P. Bohan, and T. L. Gloriod. Available from NTIS, Springfield, Va., 22151 as AD-754 536 Price \$3.00 printed copy; \$0.95 microfiche. Research Report H-72-3, December 1972. 37 p, 5 fig, 11 plate, 4 ref.

Descriptors: *Density stratification, *Stratified flow, *Withdrawal, *Hydraulic models, *Water quality control, Water pollution control, Desratification, Reservoir releases, Model studies.

The withdrawal zone resulting from the simultaneous release of flows from a randomly stratified impoundment through outlets located at different elevations was studied by use of a hydraulic model. Superimposing the separate and distinct velocity profiles for each of the outlets based on single-outlet operation to obtain the composite velocity profile, due to simultaneous release through two outlets, did not yield completely satisfactory comparisons between predicted and observed results. Further analyses yielded a generalized technique which involved a controlled shift of the withdrawal limits in the zone of overlap prior to superimposing the two separate and distinct velocity profiles. This technique yielded good agreement between observed and predicted selective withdrawal characteristics. When the composite velocity profile in the reservoir has been determined by the recommended method, a weighted-average technique can be applied to determine the value of any water-quality parameter in the outflow for which a vertical distribution within the reservoir is known. (Knapp-USGS) W73-11567

8C. Hydraulic Machinery

ROTARY RIG DUE FOR FACE-LIFTING, For primary bibliographic entry see Field 08B. W73-11459

OPERATION AND CAPABILITY OF THE BECKER HAMMER DRILL, Becker Drilling Ltd., Calgary (Alberta). D. W. Bennett. Canadian Mining Journal, Vol 88, No 1, p 35-37, January 1967. 4 fig.

Descriptors: Drilling, *Drilling equipment, Drilling samples, Drill holes, Unconsolidated sediments, Gravels, Canada, Pipes, Air circulation. *Application equipment, *Water wells, Well casing. Identifiers: *Hammer drills, Drill bits, Drill pipe, Mobility.

In the method of drilling described, casing is driven ahead by a diesel operated pile hammer, while air, under pressure, is forced down the annulus of a double wall casing. The air, under a pressure of about 40 psi returns up through the inside casing bringing with it material cut by the drill bit. Water or drilling fluid can be used as a carrier of chlorophyll. A direct relation is observed between organic carbon and the contents of humic acids and chlorophyll-like pigments in all samples. Maximum concentrations of organic carbon (up to 20%), humic acids (up to 2.5%), and pigments (up to 0.1%) were found in sapropel of paleoceanic sediments. Considerably smaller amounts of these compounds were found in neoeuoxic sediments and in shelf sediments laid down in oxygenated water. High concentrations of chlorophyll and pheophytin were observed in paleoceanic sediments. Accumulation and preservation of chlorophyll, pheophytin, and humic acids in Black Sea sediments, character of the sedimentary facies, lithology and particle-size distribution of the sediments, and the sedimentation rate. (Josefson-USGS)

W73-11470

NUCLEAR DUAL PURPOSE PLANTS IN REGIONAL DEVELOPMENT, Atomic Energy Commission, Oak Ridge, Tenn. For primary bibliographic entry see Field 03A. W73-11496

ENGINEERING WORKS—Field 08
Soil Mechanics—Group 8D

ALL-POSITION PRODUCTION WELDING WITH FLUX-CORED GAS-SHIELDED ELECTRODES,
Meyer Industries, Inc., Red Wing, Minn.
M. Hoitomt, and R. K. Lee.
Weld J., Vol 51, No 11, p 765-768, Nov 1972. 11 figs.
1 photo, 1 tab.

Descriptors: Welding, Quality control, Transmission lines, Aesthetics, Costs, Right-of-way, Erection, Foundations, Steel structures, Electrodes, Welded joints, Fabrication, Transmission towers.
Identifiers: *Tapered steel poles, On-site assembly, *Arc welding, Welds, Welding torches.

Tapered steel poles are being used more widely to support high voltage transmission lines, lighting complexes, and other operations which must be held in an elevated position. Because these poles are large in size, many production problems had to be solved to manufacture a reliable product. Tapered steel poles each weighing up to 80 tons and having an installed height of 260 ft. are being made. When several poles are combined, structures can be built to a height of 460 ft. An advantage of steel poles is simplicity of on-site erection. The foundation is prepared, all hardware installed on the ground, and then the pole raised into position and bolted in place. Advantages of tapered steel poles over steel lattice towers used in the past are: (1) esthetically better in appearance; (2) smaller base area required reduces right-of-way costs; and (3) increasing span lengths by using taller poles reduces number of structures per mile. Using the gas-shielded flux-cored arc welding process has improved welding efficiency by as much as 100% in the fabrication of tapered steel poles, and assured better quality of the finished product. (USBR)
W73-11501

CONTROL OF INSULATOR CONTAMINATION IN SUBSTATIONS,
Florida Power and Light Co., Miami.
J. R. Massey.
Journal of the Franklin Institute, Vol 294, No 6, p 375-383, Dec 1972. 20 figs, 3 append.

Descriptors: Salts, Cleaning, Electric power failure, Substations (Electrical), Performance, Power operation and maintenance, Switchyards (Electrical), Transmission (Electrical), Suspension insulators.
Identifiers: *Washing, Electrical insulators tests, Contamination, Wet condition, Flashover, Silicones, Dielectrics, Salt removal, Suspension insulators.

Problems associated with contamination of insulators have been recognized for over 70 yrs. Procedures used by the Florida Power and Light Company which have resulted in 6 yrs of virtually flashover-proof operations of substations located in high contamination areas are discussed. Salt contamination is more severe in coastal areas, but measurable contamination exists in all parts of the world. Contamination remains today the biggest unsolved insulator problem. Primarily, problems of salt contamination in substations and switchyards are described. Problems encountered, equipment rating and condition, possible solutions, kinds of contamination, methods of combating contamination, and frequency of maintenance are discussed. Conclusions are that: (1) work presently being done to control insulator contamination is of a temporary nature; (2) removal and replacement of silicone grease is necessary after about 2-3 yrs; (3) increased insulation reduces the need for washing between rainstorms; (4) washing can be a continuing expense unless sufficient rain falls to keep the porcelain clean; (5) conductive glaze shows promise, but must be proven; and (6) improved insulator design may improve performance. (USBR)
W73-11506

REPORT OF THE UNITED STATES DELEGATION VISIT TO THE SOVIET UNION: JULY 24 TO AUGUST 6, 1972,
Bureau of Reclamation, Washington, D.C.
E. L. Armstrong.

Report Electr Power Transm Power Generation Facil, US-USSR Exchange Agreement, Moscow, July-Aug, 1972, Dec 1972. 24 p, 2 map, 29 photo.

Descriptors: *Transmission lines, *Foreign products, Hydroelectric power, Power transformers, Electrical design, Extra high voltage, Substations (Electrical), Alternating current, Direct current, Turbines, Transmission (Electrical), Generators.
Identifiers: Hydroelectric powerplants, Ultra high voltage, Bratsk Powerplant (USSR), Irkutsk Powerplant (USSR), Bratsk Dam (USSR), Volgograd-Donbas Line (USSR), Volgograd Powerplant (USSR), USSR, Power grids, Power dispatching, Converters (Electrical).

Under the 1972 US-USSR Exchange Agreement, the first US delegation spent 2 wks visiting high-voltage transmission and hydroelectric power facilities in the USSR. The first stop was Moscow where the Chagino Substation, the Central Dispatching Center, ELECTRO-72 Exposition, and the Lenin All-Union Electric-Technical Institute were visited. The Konakovo Steam Power Station, 137 km north of Moscow, was on the next stop. A 750-kv, d-c transmission line connects this power station with Moscow. In Leningrad the Research Institute of Direct Current, Electrosila, and the Leningrad Metal Works were toured. In these plants large generators and turbines are manufactured for installation throughout the USSR. The Volgograd Hydroelectric complex was next, where the d-c Converter Station for the 300-kv, d-c line to the Donbass area is located. The greatest distance between tour sites was to Irkutsk, Siberia, 3200 mi from Moscow, where the Irkutsk Hydroelectric Plant, Bratsk Dam and Powerplant, and Lake Baikal were visited. A short discussion is given on each installation. (USBR)
W73-11508

SOLUTION OF PROBLEMS ON INTERCONNECTED AC SYSTEMS BY MEANS OF HVDC TRANSMISSION SYSTEMS,
R. Bartenstein, and E. Rumpf.
Paper Int Conf Large High Tension Electr Syst (CIGRE), Study Comm No 32, Jan 1972. 15 p, 2 fig, 15 ref.

Descriptors: *Extra high voltage, *Direct currents, Alternating currents, Transmission (Electrical), Reliability, Costs, Electric power demand, Electric power production, Bibliographies, Foreign research, Power operation and maintenance, Europe.
Identifiers: Load flow, Germany, Overcurrent, Valves (Electrical), *Interconnected systems, *Thyristors, *Power grids.

CIGRE Study Committee 32 (system planning and operation) discusses large electrical power supply networks operated in an interconnected AC system. Topics commented upon are: (1) questions confronting the planning engineer; (2) control, protection, and reliability of HVDC transmission systems with thyristor valves; (3) possible applications of HVDC systems; (4) coupling of networks; (5) feed-in of generating capacity; (6) integration of an HVDC system into the AC interconnected system; and (7) superimposed HVDC interconnected systems. Expected increases in power consumption in the next 2 decades will present many technical problems in operating the 400-kv AC interconnected system in Europe. Applying HVDC transmission as short distance links and for feed-in capacity may solve some of these problems. Reliability and availability are important criteria in considering HVDC transmission for interconnected grid systems. Marked improvement is expected from using thyristor valves. (USBR)
W73-11521

8D. Soil Mechanics

BEHAVIOUR OF FINE SANDS AND SILTS DURING THE RISE OF GROUND-WATER LEVEL,
Ceskoslovenska Akademie Ved, Prague. Ustav Teoreticke a Aplikovane Mechaniky.
For primary bibliographic entry see Field 02G.
W73-11194

PORE PRESSURE MEASUREMENTS IN AELOTROPIC PEAT,
Helsinki Univ. of Technology, Otaniemi (Finland).
Dept. of Civil Engineering.
For primary bibliographic entry see Field 02G.
W73-11195

INFLUENCE OF WEATHERING ON EFFECTIVE VALUES OF SHEAR STRENGTH OF MIocene CLAY,
For primary bibliographic entry see Field 02K.
W73-11196

RELATIONSHIPS BETWEEN VOLUME AND PORE-WATER CHANGE AND SHEAR STRESS IN GRANULAR SOILS,
Ceskoslovenska Akademie Ved, Prague. Ustav Teoreticke a Aplikovane Mechaniky.
For primary bibliographic entry see Field 02G.
W73-11197

BEHAVIOUR OF TRANSITION SOILS UNDER THE EFFECT OF WATER,
Technical Univ. of Budapest (Hungary).
For primary bibliographic entry see Field 02G.
W73-11198

GROUND RUPTURE IN THE BALDWIN HILLS,
Earth Sciences Associates, Palo Alto, Calif.
For primary bibliographic entry see Field 05E.
W73-11206

EFFICIENCY OF WELL SCREENS AND GRAVEL PACKS: FINAL REPORT OF RESEARCH PANEL, NO 6.
Institution of Water Engineers, London (England).

Institution of Water Engineers Journal, Vol 23, No 6, p 355-368, June, 1969. 2 fig, 6 ref.

Descriptors: Wells, Water wells, *Well casings, *Well screens, *Gravels, Efficiencies, Unconsolidated aquifers, Hydraulics, Hydraulic structures, *Specific yield, Drilling, Drilling equipment, Rotary drilling.
Identifiers: *Gravel packing, Cable tool drilling.

A Research Panel was set up to investigate the efficiency of well screens and gravel packs used in the construction of water wells, taking into account the strata concerned. Conclusions reached by the panel include: Where physical conditions permit, the reverse-circulation drilling method should produce the most satisfactory results. Consideration should be given to the mechanical strength of the screen tube material to withstand the conditions occurring and to the effect of the water quality on the corrosion-resistance of this material. Although costly, stainless steel tubes would normally be recommended. It was found through experimentation and survey that both even-sized grain size and graded-grain size gravel packs can give perfectly satisfactory results, provided that precautions are taken to minimize segregation in placing a graded pack. Subjects worthy of further investigation are also noted. (Smith-NWWA)
W73-11474

Field 08—ENGINEERING WORKS

Group 8D—Soil Mechanics

EXPANSION OF CYLINDRICAL PROBES IN COHESIVE SOILS,

Laboratoire Central des Ponts et Chaussées, Paris (France).

F. Baguelin.

J Soil Mech Found Div, Am Soc Civ Eng, Vol 98, No SM11, p 1129-1142, Nov 1972. 11 fig, 1 tab, 15 ref, 2 append.

Descriptors: *Soil tests, Pressure measuring instruments, *Cohesive soils, Earth pressure, Boreholes, Theoretical analysis, Soil mechanics, Bibliographies, Stress, Expansion, Soil properties, Shear strength.
Identifiers: *Menard pressuremeter, *Pressure probes, France, Foreign studies.

Cylindrical expansion tests cannot only solve foundation problems by empirical method but are also a means to study the undrained behavior of cohesive soils. Standard cylindrical expansion tests are usually performed in boreholes or after driving in coarse soils. A new pressure probe, the autoforeuse, has been developed and is much more sophisticated than the standard probe. The new device is a thin walled sampling tube (8 cm dia) with a pressure probe section of 0.2 mm smaller diameter than the cutting edge. The small difference in dimensions between the probe and cutting edge causes little movement in the soil before the expansion test begins. As the probe is pushed or rotated downward, the sample is chopped by a rotating tool and a fluid causes the cuttings to flow up the center of the device to the ground surface. Undrained soil tests at controlled deformation rates are performed by connecting the probe to a waterfilled cylinder with a piston. Theoretical analysis shows that the undrained stress-strain curve of the soil can be derived from the pressure meter curve. Information obtained from a few cohesive soils includes: horizontal at rest pressure, undrained stress-strain curve, and in situ undrained cohesion. (USBR)

W73-11520

WETTING REQUIREMENTS TO IMPROVE COLLAPSING FOUNDATION SOILS,

Bureau of Reclamation, Denver, Colo.

J. P. Bara.

Paper, American Society of Civil Engineers, Annu Natl Environ Eng Meet, Houston, Tex, Oct 1972. 22 p, 9 fig, 1 tab, 8 ref.

Descriptors: *Foundation investigations, Infiltration, Flooding, Foundations, Seepage, Wells, Soil investigations, Infiltration rates, *Subsidence, Subsurface investigations, Soil mechanics, Liquid limits, Wetting, Sprinkling, Settlement (Structural), *California.
Identifiers: *Collapsing soils, San Luis Canal (Calif), Hydrocompaction, Collapse phenomenon, Wetlands Distribution System (Calif).

In California, approximately 100 mi of pipelines (up to 5 ft dia) and 30 pumping plants and reservoirs will be built on collapsing soils. To avoid structural problems caused by differential settlement from future irrigation along the water distribution system, collapsing soils are wetted before construction to produce a more stable foundation condition. To evaluate methods of wetting collapsing soils, test sections were installed using flooding and sprinkling methods with and without vertical infiltration wells. Results indicate: (1) surface flooding or sprinkling in conjunction with 40-ft deep wells on 40-ft centers collapsed a 50-ft depth of soil in only 30 days; (2) surface flooding or sprinkling without wells conserves water, but takes 60 to 90 days to reach a 50-ft depth, providing impervious layers do not prevent vertical infiltration; and (3) surface flooding with 100-ft deep wells on 100-ft centers required 4 months wetting time to reach a depth of 110 ft. Soil samples of the foundation material are taken for liquid limit tests. Collapse of the foundation soils may occur when the soil liquid limit moisture is less than soil moisture at saturation. (USBR)

W73-11526

SE. Rock Mechanics and Geology

LOCATION AND DETERMINATION OF DEPTHS OF SUBSURFACE UNDULATIONS BY SEISMIC METHODS,

Kentucky Univ., Lexington. Dept. of Civil Engineering.

S. R. Smith.
M Sc Thesis, 1971. 83 p, 21 fig, 1 tab, 13 ref, 4 append. OWRR A-026-KY (1).

Descriptors: *Subsurface investigations, *Geological surveys, *Geologic formations, *Beds (Stratigraphic), *Seismic studies, Geomorphology, Depth, Methodology, Data collections, Computer models, Correlation analysis, Boreholes, Curves.
Identifiers: *Subsurface undulation measurement, Rock profiles.

The refraction survey provides a method for investigating the subsurface. Seismic waves, produced by impacts of a sledge hammer on a steel plate, are transmitted into the earth and received by vibration detectors placed at the rock surface. The lapsed time between impact and pickup is measured over 2-foot intervals in the survey. Elapsed times are plotted versus the horizontal distances between impact and detector. Computer simulation of the seismic refraction process was developed and the traveltimes curves of horizontal, dipping, hump, vee, double-vee, and triple-vee rock profiles were obtained. Equations for traveltimes curves were written to evaluate depths. The results of the data were quite accurate as verified by auger borings at 5-foot intervals along the survey line. Appendices with the derivation of equations are included as well as the computer programs used to obtain the computer traveltimes curves and a diagram for each program to illustrate the input. (Woodard-USGS)

W73-11598

TYPICAL LOG-CURVE SHAPES INDICATE FORMATION CHARACTERISTICS,
Dresser Industries, Inc., Houston, Tex.

For primary bibliographic entry see Field 08A.

W73-11456

ABNORMAL PRESSURES IN DEEP WELLS OF SOUTHWESTERN LOUISIANA,

Tulsa Univ., Okla.

P. A. Dickey, C. R. Shriram, and W. R. Paine.
Science, Vol 160, No 3828, p 609-615, May 10, 1968. 7 fig, 1 tab, 22 ref.

Descriptors: Wells, *Deep wells, Louisiana, Oil industry, Geologic investigations, Geologic control, *Faults (Geologic), *Hydrostatic pressure, Shales, Diagenesis, Compaction, Sedimentary structures, Sedimentation, *Pore pressure.
Identifiers: Salt domes, Slumps (Geologic).

In drilling deep wells in southwest Louisiana, fluids—either oil, gas, or water—at pressures much higher than normal hydrostatic pressure are often encountered. Complex 'down to the basin' growth faults were found to exist in the area, which seal the flow of fluids; down-dip from these faults abnormally high pressures are found. Shales in these intervals are less compacted than is usual at the depth at which they are buried, since the normal processes of compaction and diagenesis were arrested by the faulting. The pore water has remained in the sediments, where it has to support part of the weight of the overburden, and its hydrostatic pressure is, therefore, much above normal. In a few areas, called embayments, the growth faulting caused certain stratigraphic units to be abnormally thick, and the abnormal pressures are found at particularly shallow depths. (Smith-NWWA)

W73-11464

STUDY OF THE BEHAVIOR OF A ROOF WITH VARIOUS BOLTING SYSTEMS,

O. Leonet, P. Sinou, and E. Tincelin.

Paper III-6, Symp Int Soc Rock Mech, Nancy, France, 1971. Transl from Fr, Bur Reclam Transl 860, Jan 1973. 17 p, 8 fig, 3 ref.

Descriptors: *Rock bolts, *Rock mechanics, Tunnel construction, Anchor bolts, Structural behavior, Unlined tunnels, Strain, Resins, Loads (Forces), Load distribution, Mines, Tunnels, Grouting.

Identifiers: Expansion bolts, France, Foreign studies, *Roof bolts.

Roof deflections of an iron mine were measured in areas strengthened by expansion bolts (point anchorage) and concrete- or resin-sealed bolts (distributed anchorage). In all test series, the thickness of roof supported was 1.75 m and the bolts used were: (1) expansion bolts, 1.8 m long, installed vertically; (2) expansion bolts, 3 m long, installed at 55 deg slant; and (3) concrete-sealed notched steel bolts, 1.8 m long, installed vertically. Deflection results after 8 yrs indicated insignificant differences between roof performance with slanted or vertical expansion bolts, but showed about a 33% deflection decrease with concrete-sealed bolts. Tests with resin-sealed bolts were performed under worse geologic conditions, but also indicated better deflection performance than with expansion bolts. Behavior of the roof with resin-sealed bolts was essentially the same whether the bolt shanks were notched or smooth. To better understand the functioning of resin-sealed bolts, bolt shanks were instrumented with strain gages before being sealed into the roof. Test results indicate: (1) nonuniform distribution of load in the shank, (2) very low stresses in the first 20 cm of shank from the roof indicating that a plate should be applied to the roof, and (3) possibly poor shank attachment near the end of the hole. (USBR) (U)

W73-11503

8F. Concrete

DIAMOND BITS CORE SAMPLES OF NEW YORK ROADS.

For primary bibliographic entry see Field 08A.

W73-11461

WET WELL WOES,

Saint Petersburg Beach City Engineers, Fla.

For primary bibliographic entry see Field 08A.

W73-11462

FLEXURAL FATIGUE STRENGTH OF STEEL FIBER REINFORCED CONCRETE BEAMS,

Clarkson Coll. of Technology, Potsdam, N.Y.

G. Batson.

Journal of the American Concrete Institute, Proceedings, Vol 69, No 11, p 673-677, Nov 1972. 1 fig, 4 tab, 12 ref.

Descriptors: *Reinforced concrete, Beams (Structural), Deflection, Loads (Forces), Laboratory tests, Concrete technology, Concretes, Failure (Mechanics).

Identifiers: *Fatigue tests, *Flexural strength, *Reinforcing materials, *Steel fibers, Microcracks, Composite beams, Cracking, Cyclic loads, Fibers, Static tests, Dynamic tests, Concrete tests, Fatigue (Materials), Test results.

To determine the effectiveness of steel fiber reinforcement in resisting fatigue loads, beams containing different sizes of fiber and percentages by volume of mortar, were cast and tested in flexural fatigue. The test program consisted of static and cyclic flexural loading of concrete beams reinforced with short lengths of randomly spaced steel fibers. 130 beams, 4 by 6 by 102 in. were cast. Fibers were made from hard-drawn, low-carbon

ENGINEERING WORKS—Field 08

Materials—Group 8G

steel wire cut to specified lengths. Tensile strength of the wire as drawn was approximately 200,000 psi. Several sizes of steel fibers were used as reinforcement in concentrations of 2.00 and 2.98% by volume of concrete. Statistical analysis of test data indicated fatigue strengths of 74 and 83% of the first crack static flexure strength at 2 million cycles of complete reversal and nonreversal loading, respectively, were obtained for a steel fiber content by volume of 2.98%. Postfatigue static flexure strength was greater than the prefatigue static flexure strength. Beams failed by the pulling out of the fibers, not by breaking them. (USBR) W73-11498

SIMPLIFIED COMPUTER APPROACH TO THE ULTIMATE LOAD ANALYSIS AND DESIGN OF REINFORCED CONCRETE FRAMES.

Indian Inst. of Tech., Madras.

C. S. Krishnamoorthy, and C. W. Yu.

Journal of the American Concrete Institute, Proceedings, Vol 69, No 11, p 690-698, Nov 1972. 6 fig, 2 tab, 11 ref.

Descriptors: *Structural analysis, *Frames, *Ultimate strength design, *Reinforced concrete, Beams (Structural), Bending moments, Columns, Structural design, Compatibility, Computer programs, Hinges, Loads (Forces), Moments, Moment distribution, Foreign research, Concrete structures, Buildings.

Identifiers: *Limit design, *Plastic hinges, Limit analysis, Computer-aided design, Great Britain, Supports, Structural concrete.

An efficient and practical procedure is presented for ultimate load design of reinforced concrete frames. The proposed procedure, by adjusting rotation for the simplified limit method, provides rapid convergence of solution. A computer program was developed for analyzing reinforced concrete frames for 5 different cases of hinge pattern under 2 ultimate loading conditions. Three multistory frames were designed to illustrate the use of this program. Salient details of design and analytical results are presented. Amount of moment redistribution in these frames is discussed. The frames were tested analytically to determine actual load at failure using a separate program developed for stage-by-stage analysis of reinforced concrete frames. The program is capable of determining the moment redistribution at all critical sections for the specified cases of hinge pattern. Practical examples of multistory frames are presented to illustrate that the recommended design procedure is efficient and practical. (USBR) W73-11499

BUTIMINOUS BLANKET FOR DIKE AT LUDINGTON PUMPED STORAGE PROJECT,

Strabag Bau A.G., Cologne (West Germany).

J. Lehnert, and F. P. Robertson.

Civ Eng Vol 42, No 12, p 54-57, December 1972. 2 fig, 5 photo.

Descriptors: Asphalts, *Bituminous materials, Binders, Linings, *Reservoir construction, Erosion control, *Construction, *Construction materials, Pumped storage, Construction equipment, *Dikes.

Identifiers: Asphalt moisture barriers, Ludington Pumped Storage Project (Mich), *Impervious blankets, *Bituminous concretes.

Although over 20 pumped storage reservoirs have been built in the European area with bituminous seals, the Ludington Project on the eastern shore of Lake Michigan is only the third built in the U.S. Ludington, with a peaking power generation of 1.87 million kw, will be the most powerful pumped storage project in the world. The 80,000 acre-ft reservoir is surrounded by a fine sand and silt dike with a crest length of 5.6 mi and average height of 103 ft. To seal the reservoir, the inner slope of the

dike is paved with 2 blankets of asphalt separated by a layer of drain rock. A 3- to 5-ft-thick layer of impervious clay lines the reservoir bottom and overlaps the asphalt blankets. Much of the asphalt used, called hydraulic asphalt concrete, has a higher mineral filler content than normally used in the U.S. When undergoing differential settlement, bituminous blankets have a self-healing property not found in portland cement concrete blankets. To place 513,000 tons of asphalt concrete and 390,000 cu yds of drain rock in a 11-1/2-mo period, special paving rigs and materials handling methods were developed. (USBR) W73-11504

TORSIONAL STIFFNESS OF REINFORCED CONCRETE MEMBERS SUBJECT TO PURE TORSION,

Chalmers Univ. of Technology, Goteborg (Sweden).

I. Karlsson, and L. Elfgen.

Mag Conc Res, Vol 24, No 80, p 149-156, Sept 1972. 14 fig, 19 ref.

Descriptors: *Reinforced concrete, *Failure (Mechanics), *Stress analysis, *Beams (Structural), Deformation, Rotation, Structural analysis, Structural design, Structural behavior, Structural engineering, Loads (Forces), Theoretical analysis, Cracking, Cracks, Foreign research, Bibliographies.

Identifiers: Sweden, Torsion, Stiffness, Moments, Cracking, Test results.

A theoretical investigation on the stiffness variation of cracked concrete members loaded by a pure torsional moment is summarized. Knowledge of this property and the influence of cracking is essential for estimating the magnitude of deformation. The method used for determining stiffness is based on a truss analogy for torsion. Stresses in the reinforcement and concrete of a beam under torsional load at the cracked stage were deduced. Theoretical expressions for the torsional stiffness were then obtained for members of arbitrary and rectangular cross sections. Theoretical values agreed well with experimental results for rectangular beams with the same areas of transverse and longitudinal steel. Increases in deformation after cracking can be seen by comparing stiffness values for a solid rectangular section at the uncracked and cracked stages. Stiffness decreases considerably after cracking and may diminish to levels of about 5% of the original value. Applicability of the theory is discussed briefly and a procedure given for correcting imperfections. (USBR) W73-11519

CEMENT MORTAR LINING OF 20-FT DIAMETER STEEL PIPE,

Ameron Pipe Lining Div., Wilmington, Calif.

J. E. Wolfe.

Trans Eng J, American Society of Civil Engineers, Vol 98, No TE4, p 837-845, Nov 1972. 5 fig, 2 ref.

Descriptors: Aqueducts, Conduits, Conveyance structures, Hydraulic structures, Pipelines, Pressure conduits, *Steel pipes, *Mortar, Cements, Protective coatings, Tunnels, *Tunnel linings, Tunnel construction, Precast concrete. Identifiers: California Aqueduct, *Pipe linings, *Tunnel supports, Liner plates.

The rapid advancement in the art of cement mortar lining of steel pipelines has led to the application of in-place mortar lining in a 20-ft-dia steel cylinder in 2 tunnels and 1 siphon, for 9630 linear ft. These structures are part of the Foothill Feeder system of the Metropolitan Water District of Southern California (MWD). Because of size, these structures were originally designed for 2-in-thick mortar lining placed by the gunite method. However, 2 yrs of experiments demonstrated that

1-1/2 in. of mortar lining could be applied in the 20-ft-dia range and give a dense, tight-to-the-wall, smooth lining without using wire mesh. As a result of the experiments, MWD accepted a design change because of cost savings and better performance. The techniques used in lining these large conduits are described. The lining was installed in 2 applications, each 3/4-in thick. The second application (troweled) was placed 1 day following the first pass (untroweled). Besides being the largest pipe ever lined by this method, lining was applied at a distance 6 times greater than normal from the access opening, and the quantity of mortar placed per day per crew was approximately 3 times greater than ever before. (USBR) W73-11522

INTERNAL CRACKING IN REINFORCED CONCRETE MEMBERS,

King's Coll., London (England).

J. M. Illston, and R. F. Stevens.

Paper CP 15/72, Build Res Sta, G B, p 28-31, Aug 1972. 5 fig, 7 ref.

Descriptors: Concretes, Reinforcement, *Reinforced concrete, *Concrete tests, *Cracks, Corrosion, Beams (Structural), *Resins, Tensile stress, Bonding, Codes, Foreign research, Investigations, Laboratory tests.

Identifiers: Great Britain, *Cracking, Composite beams.

Surface cracking of reinforced concrete members in the tensile zone has always been viewed with concern because of unknown conditions inside the members. To investigate the process of cracking and the practical implications, loaded reinforced concrete beams and cylinders were injected with resins and sawn open to reveal the internal pattern of continuous cracking. The test confirms that at the working level of steel stress, the crack spacing is a function of concrete cover, and the external crack width is a function of crack spacing and steel stress. In all cases, positions of the main continuous cracks were marked by resin staining the bar recess and bar surface. Splurges of resin indicate breakdown of adhesion bond but not necessarily complete loss of bond action. Typical cracks take a distorted form and only can be properly examined in 3 dimensions. The process of cracking as the stress in the steel is increased is explained in 4 stages of development. Observations indicate that the width of a single crack is a most variable quantity; therefore, measurements are unlikely to be reproducible. (USBR) W73-11523

8G. Materials

OXYGEN-A MAJOR ELEMENT IN DRILL PIPE CORROSION,

Shell Development Co., Houston, Tex.

B. W. Bradley.

Materials Protection, Vol 6, No 2, p 40-43, December 1967. 9 fig, 2 tab, 5 ref.

Descriptors: Corrosion, Corrosion control, Erosion, Drilling, Drilling equipment, Drilling fluids, Wyoming, Louisiana, Oil industry, Sea water, Pitting (Corrosion), *Oxygen, Cracks, Laboratory tests, Hydrogen ion concentration.

Identifiers: Scavenging (Chemical).

Recently oxygen was suspected to cause internal corrosion of drill pipe which was circulated with lignosulfonate drilling mud. Tests were conducted to determine if this suspicion was justified and to determine the precise effect by measuring corrosion rates. A correlation was indicated in the results between oxygen concentration of the drilling fluid, corrosion and pitting. Conclusions reached from data presented are: Corrosion at different locations with the ligno-sulfonate mud was

Field 08—ENGINEERING WORKS

Group 8G—Materials

approximately the same; untreated sea water mud was twice as aggressive to drill pipe rings as lignosulfonate mud; at one location the upper ring tended to be attacked more than the lower ring. This is compatible with the concept of oxygen scavenging by the mud, and therefore, reduced corrosion, as the mud travels down the drill pipe; when the exposure time was tripled, the corrosion rate was reduced four times; velocity may cause erosion effects which overshadow simple corrosion. (Campbell-NWWA)
W73-11453

HIGHLY RESISTANT COPPER DETERIORATES IN SEVERELY CORROSION SOILS

National Bureau of Standards, Washington, D.C.
W. J. Schwerdtfeger.

Materials Protection, Vol 7, No 9, p 43-44, September 1968. 2 fig, 1 tab, 3 ref.

Descriptors: Corrosion, *Corrosion control, *Cathodic protection, Anodes, Cathodes, Soil chemical properties, Acidity, Pitting (Corrosion), Resistivity, Materials, *Soils, *Copper.
Identifiers: Sulfuric acid, *Galvanic corrosion.

Tests were conducted to establish the amount of cathodic protection necessary for copper in a severely corrosive soil. It is generally assumed that copper has a higher resistance to corrosion in soils than do the other commonly used metals, but data indicate that the corrosion rate of copper in severely corrosive soils can be quite rapid. Experimental methods plus results of tests which concern copper corrosion are discussed. The laboratory data discussed indicate that the break in the cathodic polarization curve is a reasonable criterion of cathodic protection. At times, the cathode potential did not differ from the control potential by more than 50 MU. Corrosion was under cathodic control. Should copper need protection in similar very corrosive environments, a minimum charge of 100 MU might be a reasonable criterion. (Smith-NWWA)
W73-11454

CORROSION OF METALS IN TROPICAL ENVIRONMENTS—COPPER AND WROUGHT COPPER ALLOYS

Naval Station, Canal Zone. Fuel Div.
C. W. Hummer, Jr., G. R. Southwell, and A. L. Alexander.
Materials Protection, Vol 7, No 1, p 41-47, January 1968. 10 fig, 3 tab, 18 ref.

Descriptors: *Corrosion, Corrosion control, *Tropical regions, *Copper, *Copper alloys, Panama canal, Bronze, Sea water, Cathodic protection, Anodes, Aluminum, Aluminum alloys, Steel.
Identifiers: Dezincification, Panama, Brass, *Atmospheric corrosion.

The corrosion of copper and nine wrought copper alloys is reported for exposures in five tropical environments for periods of 1, 2, 4, 8, and 16 years. Weight loss, depth of pitting, and change in tensile strength were measured to evaluate corrosion resistance. Specific areas discussed include underwater corrosion of copper alloys, dezincification of brasses, galvanic effects, biofouling of copper vase metals, and atmospheric corrosion of copper alloys. Five exposure sites were involved, covering marine atmospheric, tropical fresh water, inland atmospheric, tropical sea water lagoon, and ocean environments. Weight loss, pit depth, and dimensional change were determined by standard procedures. Copper and copper alloys exposed to tropical sea water show weight losses from 1.4 to 2 times greater than in temperate waters. Tropical marine atmospheres also cause higher weight loss to cuprous metals. Heavy dezincification occurred in the A plus B brasses in sea water. (Campbell-NWWA)
W73-11455

EXTERNAL CORROSION OF BURIED FERROUS PIPELINES/1

Harsco Corp., Hawthorne, Calif.
H. W. Hosford.

Water and Wastes Engineering, Vol 6, No 11, p 45-47, November 1969. 5 fig, 3 ref.

Descriptors: *Corrosion, Anodes, Cathodes, Electrolytes, Underground structures, Pipelines, Materials, *Metal pipes, Cos analysis, Rusting, Resistivity, *Soil chemistry, Soil properties.
Identifiers: *Electrolytic corrosion, Galvanic cells, *Galvanic corrosion, Ferrous pipelines.

The importance of the environment in the corrosion of buried pipe is emphasized in this discussion of soil types and properties, galvanic and electrolytic mechanisms of corrosion, and variations in pipeline materials and construction. The rate at which a material will corrode and the economics of appropriate corrosion control methods are important factors in the selection of construction materials. In an underground environment there are many types of soils with widely varying characteristics. Generally, the lower the resistivity of the soil, the more corrosive the environment. When metals are placed in soil, they corrode by two mechanisms: galvanic and electrolytic. Galvanic, probably the larger contributor, is a self-generating activity caused by environmental differences around or within the metal. In the electrolytic corrosion process current is forced to leave a buried metal structure that is in the vicinity of an electrified railway, streetcar, or highvoltage d-c electrical distribution system. The current flows onto the structure at some points (cathodic areas) but at other points (anodic areas), where the current leaves the structure, corrosion occurs. (Campbell-NWWA)
W73-11467

CATHODIC PROTECTION—THEORY AND PRACTICE IN THE WATER INDUSTRY

Corrosion Engineers Ltd., Alresford, (England).
For primary bibliographic entry see Field 08A.
W73-11472

FOUR PHENOMENA AFFECTING CATHODIC PROTECTION AND CORROSION RATES

Caproco Corrosion Prevention Ltd., Edmonton (Alberta).
F. W. Hewes.

Materials Protection, Vol 8, No 9, p 67-71, September 1969. 6 fig, 6 tab, 10 ref.

Descriptors: Corrosion, *Corrosion control, *Cathodic protection, Underground structures, *Electro-osmosis, Electric currents, Resistivity, *Alternating currents, Anodes, Direct currents, Sulfur bacteria, Coatings.
Identifiers: Ground beds, *Current density (Electrical), Polarization.

The background and significance of (1) electro-osmosis, (2) coating holiday size, (3) a-c discharge, and (4) underfilm moisture are discussed. Electro-osmotic effects have a direct influence on the operation of ground beds and on certain phenomena at the protected cathode. The current density for a given driving voltage varies inversely with the holiday size. The smaller the holiday the greater the current density. Alternating current flow between a metal and an electrolyte does result in corrosion, although for steel and copper, the rate is only 0.1% of the corrosion that would theoretically be expected from the same d-c magnitude. While there can be areas in contact with moisture under a disbonded coating that are not reached by cathodic protection, the rate of corrosion at those areas the cathodic protection doesn't reach is under most conditions insignificant or definitely self-limiting. (Campbell-NWWA)
W73-11475

CATHODIC PROTECTION—THE ANSWER TO CORROSION PREVENTION OF UNDERGROUND STRUCTURES

Hinchman Co., Detroit, Mich.
L. H. West.

Materials Protection, Vol 7, No 7, p 33-34, July, 1968. 2 fig, 2 ref.

Descriptors: Corrosion, Corrosion control, *Cathodic protection, Underground structures, Utilities, *Cost analysis, Economics, Graphical analysis, Pipes, Pipelines, Materials, Failures, Coatings, Construction, Pitting (Corrosion), *Design criteria.
Identifiers: Corrosion potentials.

Cathodic protection should be considered only as one portion of a corrosion control program. A brief guide for the comprehensive engineering of a corrosion program is presented. Included is discussion on failure repair, replacement, coating and cathodic protection, heavier wall thickness, changes in construction practices, etc. Two major classifications are presented, which require somewhat different considerations. These are (1) new construction and (2) existing structures. Proper application of cathodic protection to new construction should include a study of experiences of others in the same area, soil type, drainage, water table, and existing structures on the same site. Modifications to general construction practices can reduce total costs and make cathodic protection more practical. The same factors must be studied when cathodic protection is applied to existing structures. However, with existing structures, a history is generally available. Failure rate and pitting experience should be analyzed to give a true picture of past, present, and future conditions. (Campbell-NWWA)
W73-11477

PROCEDURE IMPROVED FOR DETERMINING CORROSION RATE BY WEIGHT LOSS

Naval Civil Engineering Lab., Port Hueneme, Calif.
E. S. Matsui.

Materials Protection, Vol 7, No 7, p 31-32, July, 1968. 4 tab, 3 ref.

Descriptors: Corrosion, Corrosion control, *Materials testing, *Laboratory tests, *Statistical methods, Coatings, Preservation, Salts, Docks.
Identifiers: Salt spray, Ballast tanks, Preservatives.

During recent tests, a discrepancy was discovered in the procedure for salt spray testing provided in MIL-C-2305 (ships) for determining metal corrosion rate. The procedure did not consider non-homogeneity of material among panels being tested. The standard test was conducted as follows: low carbon steel panels were sandblasted, weighed to .01 g, and coated with preservative approximately 1/8 inch thick. After being exposed for 15 days to 20% salt spray the panels were degreased with benzene, and acid-cleaned in inhibited 1.0 to 1.5 N hydrochloric acid at 83°C. After cleaning, all panels were rinsed with distilled water, rinsed in acetone, and air dried. The dried panels were weighed to .01 g. The modified test method differs from the original method in one important respect. It uses the individual test specimen itself as a blank in order to reduce variation in weight losses when test panels from different batches are exposed to the same treatment during the acid cleaning procedure. (Smith-NWWA)
W73-11478

A LITERATURE SURVEY—PERFORMANCE OF EXCEPTIONAL METALS IN CORROSIVE ENVIRONMENTS

National Association of Corrosion Engineers, Houston, Tex.
N. E. Hamner.

ENGINEERING WORKS—Field 08

Materials—Group 8G

Materials Protection, Vol 6, No 10, p 31-39, October, 1967. 7 fig, 1 tab, 65 ref.

Descriptors: Corrosion, *Corrosion control, *Materials, Materials testing, *Metals, Metallurgy, Research and development, Research priorities, *Alloys, Abstracts, Beryllium, Titanium, Calcium, Boron, Cadmium, Cesium, Cobalt, Gold, Manganese, Mercury, Molybdenum. Identifiers: Fuel cells, *High temperature applications, Atomic energy.

Among metals discussed are barium, beryllium, bismuth, cadmium, cesium, columbium, gallium, gold, hafnium, indium, iridium, lithium, manganese, molybdenum, plutonium, silver, tantalum, tungsten, and zirconium. Broad interest has been shown in these metals by scientists and engineers, as indicated by approximately 3480 abstract references reported by the author during 1965-1967. The reasons for the growing interest in these metals include the development of atomic energy for the production of electrical power, the growing development of high temperature systems, the need for molten metals (i.e., sodium) in primary circulating systems of atomic power systems, and the need for chlorine-resistant materials to be used in large-scale desalting-generating plants. Thermoelectric generators are also getting their share of attention in the hope that their efficiency can be increased both by design and material selection. The requirement for reliability in modern systems has opened the way for investigation of materials which a short time ago would not have been considered. (Smith-NWWA)

W73-11479

DESIGN AND INSTALLATION OF DEEP ANODE GROUNDBEDS,

Cathodic Protection Service, Tulsa, Okla.

For primary bibliographic entry see Field 08B.

W73-11480

FLEXURAL FATIGUE STRENGTH OF STEEL FIBER REINFORCED CONCRETE BEAMS,

Clarkson Coll. of Technology, Potsdam, N.Y.

For primary bibliographic entry see Field 08F.

W73-11498

SIMPLIFIED COMPUTER APPROACH TO THE ULTIMATE LOAD ANALYSIS AND DESIGN OF REINFORCED CONCRETE FRAMES,

Indian Inst. of Tech., Madras.

For primary bibliographic entry see Field 08F.

W73-11499

ALL-POSITION PRODUCTION WELDING WITH FLUX-CORED GAS-SHIELDED ELECTRODES,

Meyer Industries, Inc., Red Wing, Minn.

For primary bibliographic entry see Field 08C.

W73-11501

STUDY OF THE BEHAVIOR OF A ROOF WITH VARIOUS BOLTING SYSTEMS,

For primary bibliographic entry see Field 08E.

W73-11503

BITUMINOUS BLANKET FOR DIKE AT LUDINGTON PUMPED STORAGE PROJECT,

Strabag Bau A.G., Cologne (West Germany).

For primary bibliographic entry see Field 08F.

W73-11504

A PROBABILISTIC APPROACH TO MAXIMUM COLUMN STRENGTH,

Lehigh Univ., Bethlehem, Pa.

For primary bibliographic entry see Field 08A.

W73-11516

NUMERICAL STATISTICS IN ENGINEERING GEOLOGY,

McGill Univ., Montreal (Quebec).

M. A. Muspratt.

Eng Geol Int J, Vol 6, No 2, p 67-78, Aug 1972. 4 fig, 2 tab, 8 ref.

Descriptors: *Statistics, *Settlement (Structural), Numerical analysis, Engineering geology, Systematics, Monte Carlo method, Stochastic processes, Regression analysis, Classifications, Mathematical models, Slope stability, Optimization, Foreign research.

Identifiers: Pile-driving formulas, Factor analysis, Pattern recognition, Statistical analysis, Mathematical analysis, Bearing capacity.

Statistical methods permit objective evaluation of detailed empirical and/or theoretical data and, therefore, permit rational decisions to be made. These methods are particularly relevant as complete, exact knowledge about nature is generally unavailable and deterministic description is impossible. Computer methods of solution are generally mandatory in view of the large quantities of information involved. Unfamiliarity with numerical tools, such as taxonomy, factorial analysis, pattern recognition, Monte Carlo simulation and its extensions, stochastic optimization, experimental design, and regression analysis seems to retard the use of statistical techniques in many branches of engineering geology. An example, using factor analysis, indicated that for a group of soil samples, particle size and bearing capacity are highly correlated, while unit weight and bearing capacity are not correlated. A pattern-recognition algorithm is described to facilitate automatic classification of data obtained from testing and instrumentation apparatus. Monte Carlo simulation is used to establish the probability distribution of the bearing capacity of a pile. Methods for analyzing settlement and other time-dependent phenomena are proposed. (USBR)

W73-11517

TORSIONAL STIFFNESS OF REINFORCED CONCRETE MEMBERS SUBJECTED TO PURE TORSION,

Chalmers Univ. of Technology, Goteborg (Sweden).

For primary bibliographic entry see Field 08F.

W73-11519

EXPANSION OF CYLINDRICAL PROBES IN COHESIVE SOILS,

Laboratoire Central des Ponts et Chaussees, Paris (France).

For primary bibliographic entry see Field 08D.

W73-11520

DESIGN, STRUCTURAL DETAILS, AND DISCONTINUITIES IN STEEL,

Lehigh Univ., Bethlehem, Pa.

J. W. Fisher and B. T. Yen.

Paper, American Society of Civil Engineers, Spec Conf Safety Reliab Metal Struct, Pittsburgh, Pa., Nov 1972. 29 p, 27 fig, 18 ref.

Descriptors: *Fatigue (Mechanics), Fractures, Steel, Structural members, Structural design, *Defects, *Structural steel, Ultrasonics, Bibliographies, Structural engineering, Reliability, Materials, Safety, Welding, *Cracks, Stress. Identifiers: *Fracture mechanics, Microcracks, Crack propagation, *Discontinuities.

To prevent fatigue and fracture of members and components of structures, material properties, fabrication procedures, loading conditions, design details, and applied stresses must be considered. Current design practices account for these factors in many ways and varying degrees of effectiveness. Systematic control against fracture has not been established, and fatigue control could be improved. Studies indicate discontinuities, ranging in

size from microflaws to several inches, exist in almost all steel structural members, either from manufacture or from fabrication by rolling, welding, machining, or punching. Orientation of the discontinuity is a major factor in considering whether the defect will develop into a significant crack. Improper design of structural members can cause high stress concentrations, high magnitudes of stress range between fluctuating loads are responsible for fatigue crack growth from flaws. Briefly discussed are: (1) initial flaws and their orientation in structural members, (2) effect of structural details and stress magnitudes on fatigue cracking, (3) propagation of crack and brittle fracture, (4) effects of residual stresses, and (5) some design considerations. (USBR)

W73-11524

DESIGNING TO PREVENT BRITTLE FRACTURES IN BRIDGES,

Kansas Univ., Lawrence.

S. T. Rolfe.

Paper, American Society of Civil Engineers, Spec Conf Safety Reliab Metal Struct, Pittsburgh, Pa., Nov 1972. 42 p, 9 fig, 1 tab, 21 ref.

Descriptors: Structural design, *Bridge design, *Steel structures, Stress analysis, Failure (Mechanics), *Bridge failure, Bridges, Fabrication, Bibliographies, Fractures, Structural steel, High strength steel, Cracks, Welding, Welded joints.

Identifiers: *Fracture mechanics, Crack propagation, *Brittle fractures.

The service experience of bridge steels has been such that the designer seldom concerned himself with the notch-toughness of bridge steels. However, recent brittle fractures in bridges dictate that the designer become aware of available analytical methods to prevent brittle fractures. Three primary factors controlling likelihood of brittle fracture in a structure are: (1) material toughness (ability to deform plastically in the presence of a notch), (2) flaw size, and (3) tensile stress level. Of the different approaches to analyzing notch-toughness of structural steels, fracture mechanics is the most useful tool in designing to prevent fracture or fatigue failures in bridges. For structures subjected to fatigue loadings, initial cracks can grow during the life of the structure. A fracture control plan should be developed for complex welded structures, such as bridges, and should consider: (1) material selection, (2) material service temperature and loading rate, (3) structural design, (4) welding control, (5) fatigue crack growth, and (6) redundancy of the structure. Fracture mechanics concepts should be used to develop fracture control plans for other complex welded structures. (USBR)

W73-11525

DETERMINING THE STRENGTH OF CORRODED PIPE,

Texas Eastern Transmission Corp., Shreveport, La.

C. W. Marvin.

Mater Prot Performance, Vol 11, No 11, p 34-40, Nov 1972. 8 fig, 3 tab, 12 ref.

Descriptors: *Pipelines, *Corrosion, *Failure (Mechanics), *Steel pipes, Pressure tests, Rupturing, Hydrostatic pressure, Yield strength, Rusting, Safety, Strength materials.

Identifiers: *Pipe tests, Corrosion fatigue, Fracture mechanics, Correlation, Destructive tests, Pitting, Surface properties, Test results, Material tests, Defects.

Recently the gas industry has attempted to resolve the problem of accurately determining the physical strength of corroded pipe. Better criteria for replacing corroded pipe can be established if the actual strengths can be determined from the geometry and material specifications of the pipe.

Field 08—ENGINEERING WORKS

Group 8G—Materials

During 1970-71, 47 full-scale instrumented hydrostatic pressure tests were conducted to determine the strength of corroded pipe which had been removed from service. Using the basic form of the NG-18 Surface Flaw Equation in the analysis, a formula was derived to analyze the strength of corroded pipe. Comparisons of predicted strength using the formula and actual failure strength of corrosion pits tested to rupture are presented. A variation of the research formula, simplified for field use in accepting or rejecting corroded pipe, is presented for maintaining safe pipeline operations. (USBR) W73-11527

A MODEL FOR RAIN EROSION OF HOMOGENEOUS MATERIALS,

Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.

G. S. Springer, and C. B. Baxi.

Available NTIS, Springfield, Va., 22151 as AD-748 790. Price \$3.00 printed copy; \$0.95 microfiche. Air Force Materials Laboratory Technical Report AFML-TR-72-106, June 1972. 53 p, 9 fig, 3 tab, 67 ref. AFC F33615-71-C-1572.

Descriptors: *Rainfall, *Drops (Fluids), *Materials testing, *Durability, Deterioration, Resistance, Aircraft, Turbine blades, Testing procedures, Mathematical studies, Equations, Data collections, Correlation analysis, Design criteria.

Aircraft components such as radomes, leading edge surfaces, helicopter blades, and various structural members may experience heavy damage when subjected to repeated impingements of rain droplets. Liquid droplets may also cause significant damage to steam turbine blades. Based on fatigue theorems, a model is presented for describing both the incubation period, n (the time elapsed before the mass loss of the material becomes appreciable), and the mass loss after the incubation period, m. The parameters which govern the length of the incubation period and the subsequent mass loss rate are established. Simple algebraic expressions are developed to relate n and m to the properties of the impinging droplets and the material. The limits of applicability of the model are also established. The results agree with experimental data. (Woodard-USGS) W73-11560

8H. Rapid Excavation

CONSTRUCTION DIFFICULTY INDEX FOR TUNNEL CONSTRUCTION,

Metropolitan Sanitary District of Greater Chicago, Ill.

S. J. Sulinski.

Presented at: Rapid Excavation and Tunneling Conference, American Society of Civil Engineers, New York, June, 5-7 1972. 19 p, 12 tab.

Descriptors: *Tunnels, *Tunneling, *Project planning, *Cost analysis, *Construction costs, Engineers estimate, Estimated costs, Illinois. Identifiers: *Chicago.

The Metropolitan Sanitary District of Greater Chicago is making a continuous study of tunnel construction costs as they relate to various construction parameters. This report analyzes the data from five such projects. Five machine-mined tunnels, all of which were in soft ground, involved the use of steel ribs and wood lagging. They had finished inside diameters of from 5 1/2 to 6 1/2 feet. The basic data recorded concerning progress per shift were: hours mined per shift, hours of downtime per shift, cause of downtime, soil profiles from soil borings and actual soil type mined. Data on manpower used and equipment type and condition were also noted. Mining progress was plotted upon soil profiles and data from the five contracts is summarized in this re-

port. Mining rates were adjusted for different conditions and average rates were as follows: stiff, silty clay—7.0 feet per shift-hour, cohesive soils—5.0 feet per shift-hour, intermediate soils—4.0 feet an hour, and granular soils—3.0 feet an hour. Only where a high incidence of boulders is indicated do the rates need to be adjusted to account for boulder removal. Preconstruction planning was found to be extremely valuable and control of groundwater was found vital to the success of operation. Preliminary soil borings were found to be a valid basis for anticipating conditions found during construction. Mining machines improvements are expected in the future. This is expected to increase speed and efficiency and lower costs. (Poertner) W73-11681

8I. Fisheries Engineering

POLLUTION AS A RESULT OF FISH CULTURAL ACTIVITIES,

Utah State Div. of Wildlife Resources, Salt Lake City.

For primary bibliographic entry see Field 05B.

W73-11077

'BENDUVALA,' A SPECIAL GEAR FOR CATCHING MAJOR CARP LABEO FIMBRIATUS (BLOCH) IN GODAVARI RIVER, WITH OBSERVATIONS ON 'BENDUVALA' FISHERY AT DUMMAGUDEM, Central Inland Fisheries Research Inst., Madras (India).

T. S. Ramaraju.

Proc Indian Acad Sci Sect B. Vol 74, No 6, p 277-283, 1971. Illus.

Identifiers: *Carp, Fishery gear, Godavari, India (Godavari River), Labeo-Fimbriatus, Rivers.

A short description of the net and its operation technique are given. Adverse effects of this equipment in the present fishery state of the river are also stressed.—Copyright 1972, Biological Abstracts, Inc. W73-11405

SURVIVAL POTENTIAL OF F1 HYBRIDS AMONG SALMONID FISHES,

Freshwater Fisheries Research Lab., Tokyo (Japan).

R. Suzuki, and Y. Fukuda.

Bull Freshwater Fish Res Lab Tokyo, Vol 21, No 1, p 69-83, 1971. Illus.

Identifiers: Culture, Fishes (Hybrids), Ponds, *Salmonid fishes, Survival potential (Fish).

Artificial crosses in Salmonidae were carried out with 62 combinations. Survival rates in early stages of development were examined to obtain satisfactory F1 hybrids for pond culture and for stocking into lakes or rivers. Hybrid development did occur in all combinations, although there were wide differences in survival rates between combinations. Hybrids from 32 combinations survived until they reached the free-swimming stage and 9 of these showed survival rates similar to or better than those of parental species. The correlation between success of hybrid development and taxonomical position of parental species were discussed. In reciprocal crosses between species with small-sized eggs and species with large-sized eggs, survival rates were higher when eggs were from small-egg species than when eggs were from large-egg species.—Copyright 1972, Biological Abstracts, Inc. W73-11653

09. MANPOWER, GRANTS AND FACILITIES

9B. Education (In-House)

SYSTEMS APPROACH TO TRAINING AND LICENSING OF WATER WORKS PERSONNEL IN ONTARIO,
Ontario Water Resources Commission, Toronto.
For primary bibliographic entry see Field 05F.
W73-11676

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

A CATALOG OF HYDROCLIMATOLOGICAL DATA FOR ALASKA'S COASTAL ZONE,
Alaska University, College Inst. of Water Resources.
For primary bibliographic entry see Field 02B.
W73-11056

THE GROWTH RATE OF ICE CRYSTALS: THE PROPERTIES OF CARBON DIOXIDE HYDRATE A REVIEW OF PROPERTIES OF 51 GAS HYDRATES,
Syracuse Univ., N.Y. Dept. of Chemical Engineering and Materials Science.
For primary bibliographic entry see Field 03A.
W73-11156

HOUSING AND PLANNING REFERENCES.
Department of Housing and Urban Development, Washington, D.C.
For primary bibliographic entry see Field 03D.
W73-11251

WATER ANALYSIS.
Geological Survey, Lakewood, Colo.
For primary bibliographic entry see Field 02K.
W73-11285

PHOSPHORUS REMOVAL, A BIBLIOGRAPHY, VOLUME I.
Office of Water Resources Research, Washington, D.C.
For primary bibliographic entry see Field 05D.
W73-11319

PHOSPHORUS REMOVAL, A BIBLIOGRAPHY, VOLUME 2.
Office of Water Resources Research, Washington, D.C.
For primary bibliographic entry see Field 05D.
W73-11320

ARTIFICIAL RECHARGE OF GROUND-WATER, A BIBLIOGRAPHY.
Office of Water Resources Research, Washington, D.C.
For primary bibliographic entry see Field 04B.
W73-11321

OPERATION OF THE ANALYTICAL METHODOLOGY INFORMATION CENTER,
Battelle Columbus Labs., Ohio.
For primary bibliographic entry see Field 05A.
W73-11336

SCIENTIFIC AND TECHNICAL INFORMATION—Field 10
Preparation of Reviews—Group 10F

ENVIRONMENTAL TERMINOLOGY INDEX.
Oak Ridge National Lab., Tenn. Environmental Information Systems Office.

Report ORNL-EIS-72-22 (2 volumes), November 1972 (preliminary edition). Vol I-232 p, 57 ref; Vol II-115 p, 57 ref. AEC W-7405-eng-26.

Descriptors: *Environment, *Thesauri, *Indexing, *Physiological ecology, Natural resources, Publications, Documentation, Technology, Technical writing, Abstracts, Ecology, Social aspects, Biology, Information retrieval.

Identifiers: *Earth sciences thesaurus, Terminology, Index.

In 1971, information meetings of the International Biological Program illustrated the urgent need for worldwide communication on practical as well as basic environmental problems. As a result this Environmental Terminology Index or Thesaurus was written as a contribution of the USA. The index includes terms in areas of physical sciences, technology, earth sciences, social sciences, biology, and ecology. To serve as a tool in information retrieval, keywords are chosen to indicate information and data content of a piece of literature or a file of numbers. A semantic definition may be provided in the thesaurus by means of scope notes or the structure which is given to the terminology. The embedded hierarchy (volume I) displays main terms, listed alphabetically, with any associated scope notes, preferences, and cross-references. A hierarchical structure is incorporated among the narrower terms for each main term. Preferred terms identify the choices made between closely related or ambiguous terms. Terms included in hierarchical structures identify the relation between descriptors at different levels of specificity. Related terms show the variety of other relationships that may exist between terms. The permuted index (volume II) displays main terms, listed alphabetically, with any associated scope notes, preferences, and cross-references. (Woodard-USGS)

W73-11387

10D. Specialized Information Center Services

OPERATION OF THE ANALYTICAL METHODOLOGY INFORMATION CENTER,
 Battelle Columbus Labs., Ohio.
 For primary bibliographic entry see Field 05A.
 W73-11336

10F. Preparation of Reviews

STATE-OF-THE-ART REVIEW OF PULP AND PAPER WASTE TREATMENT,
 Wapora, Inc., Washington, D.C.
 For primary bibliographic entry see Field 05D.
 W73-11080

WATER ANALYSIS,
 Geological Survey, Lakewood, Colo.
 For primary bibliographic entry see Field 02K.
 W73-11285

A LITERATURE SURVEY—PERFORMANCE OF EXCEPTIONAL METALS IN CORROSIVE ENVIRONMENTS,
 National Association of Corrosion Engineers,
 Houston, Tex.
 For primary bibliographic entry see Field 08G.
 W73-11479

SUBJECT INDEX

2,3-DIHYDROXYNAPHTHALENE	
2,3-Dihydroxynaphthalene as Indicator for the Complexometric Titration of Iron (III) with EDTA,	
W73-11641	5A
ABSORPTION	
Method of Removing Oil from Water,	
W73-11225	5G
Prague International Lead Panel: Effects of Atmospheric Lead on Biological Systems,	
W73-11265	5C
The Use of Atomic Absorption for Analysis of Natural Waters,	
W73-11291	5A
Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material,	
W73-11339	5A
Continuous Culture of Rhodotorula rubra: Kinetics of Phosphate-Arsenate Uptake, Inhibition, and Phosphate-Limited Growth,	
W73-11574	5A
Nitrogen and Phosphorus Uptake by Chlorella pyrenoidosa in Sewage Treatment Processes,	
W73-11617	5B
A Comparison of Benthic Microalgal Production Measured by C-14 and Oxygen Methods,	
W73-11658	5A
ACAROL	
Movement of Acarol and Terbicil Pesticides During Displacement Through Columns of Wabasso Fine Sand,	
W73-11537	5B
ACCURACY	
Atomic Absorption Spectrophotometry as a Tool for the Water Chemist,	
W73-11294	5A
ACID MINE WATER	
Fish and Food Organisms in Acid Mine Waters of Pennsylvania,	
W73-11332	5C
The Need for Hydrogeologic Evaluations in a Mine Drainage Abatement Program: A Case Study, Toms Run, Clarion County, Pennsylvania,	
W73-11674	5G
ACIDIC WATER	
Purification of Waste Water,	
W73-11238	5D
ACOUSTIC ECHO SOUNDING	
Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering,	
W73-11631	5A
ACTIVATED CARBON	
Marine Sanitation System Demonstration,	
W73-11059	5D
Activated Carbon for Water Treatment,	
W73-11352	5F
How to Black Out Algae,	
W73-11420	5F
Activated Carbon for Palatable Water: Granular or powdered.	
W73-11422	5F
ACTIVATED SLUDGE	
Aerobic Secondary Treatment of Plywood Glue Wastes,	
W73-11065	5D
Characterization of the Activated Sludge Process,	
W73-11069	5D
Activated Sludge Sewage Treatment Process and System,	
W73-11239	5D
Activated Sludge Process and System,	
W73-11240	5D
Metal Toxicity to Sewage Organisms, A Discussion,	
W73-11266	5D
Ultra High Rate Filtration of Activated Sludge Plant Effluent,	
W73-11337	5D
Secondary Waste Treatment for a Small Diversified Tannery,	
W73-11340	5D
Generic Feed Forward Control of Activated Sludge,	
W73-11362	5D
ADSORBENTS	
Alpha-Al2O3 as an Adsorbent in Thin-Layer Chromatography,	
W73-11128	5A
ADSORPTION	
Mercury Accumulation by Myriophyllum Spicatum L.,	
W73-11168	5C
Adsorption of Chlorinated Hydrocarbons from Seawater by a Crosslinked Polymer,	
W73-11443	5A
Adsorption Characteristics of Opaline Clays From the Eocene of Georgia,	
W73-11536	2G
AELOTROPIC PEAT	
Pore Pressure Measurements in Aelotropic Peat,	
W73-11195	2G
AERATION	
Cannery Wastewater Treatment with Rotating Biological Contactor and Extended Aeration,	
W73-11058	5D
Water Purification With Porous Abrasives,	
W73-11228	5D
Accelerated Biological-Chemical Wastewater Treatment,	
W73-11229	5D
Activated Sludge Sewage Treatment Process and System,	
W73-11239	5D
Activated Sludge Process and System,	
W73-11240	5D
H2S Removal from Water Without Air Pollution,	
W73-11314	5F
Taste and Odor Control - Chemicals and Methods.	
W73-11421	5F
AERIAL	
Aerial Surveillance Spill Prevention System,	
W73-11326	5B
AERIAL PHOTOGRAPHY	
Principles of Landslide Identification from Aerial Survey Data (Printsaiya raspoznavaniya opolznevnykh protsessov po materialam aerofotos'yemki),	
W73-11100	2J
An Evaluation of the Utility of Available Remote Sensor Returns for a Study of Slope Failure Phenomena,	
W73-11216	7B
Photographic Water Conservation and Reclamation Processes Study,	
W73-11403	5A
Computer Program System for Aerotriangulation,	
W73-11518	7C
Remote Sensing Evaluation of Environmental Factors Affecting the Developmental Capacity of Inland Lakes,	
W73-11540	7B
Natural Resource Information System Remote Sensing Studies,	
W73-11571	7B
AEROBACTER AEROGENES	
Enumeration and Differentiation of Water Bacteria with Phosphorus-32,	
W73-11133	5A
AEROBIC TREATMENT	
Aerobic Secondary Treatment of Plywood Glue Wastes,	
W73-11065	5D
Apparatus for Handling Sewage,	
W73-11242	5D
AEROSOLS	
Diurnal Variation of Aerosol Trace Element Concentrations in Livermore, California,	
W73-11277	5B
Some Aspects of the Geochemistry of Marine Aerosols,	
W73-11372	2K
AEROTRIANGULATION	
Computer Program System for Aerotriangulation,	
W73-11518	7C
AESTHETICS	
Aesthetic Preference for Water Resource Projects: An Application of Q Methodology,	
W73-11684	6B
AGENCY LAKE (ORE)	
Phosphorus Release from Lake Sediments,	
W73-11072	5C
AGRICULTURE	
Freeze-Free (32 F) Seasons of the Major Basins and Plateaus of Nevada,	
W73-11218	7C
AGRONOMY	
Water Requirements for Optimum Crop Yield,	
W73-11507	3F
AIR POLLUTION	
Fallout of Sodium Sulphate near a Kraft Mill,	
W73-11175	5A

SUBJECT INDEX

AIR POLLUTION

Environment, W73-11183	5C	Large-Scale and Long-Term Fluctuations in some Atmospheric and Oceanic Variables, W73-11369	2B	ALKALINITY Carbon Dioxide Dynamics: A Record of Organic Carbon Production, Respiration, and Calcification in the Eniwetok Reef Flat Community, W73-11488	5A
Composition of Airborne Lead Particles, W73-11188	5A	ALABAMA Water Resources Data for Alabama, 1970: Part 2. Water Quality Records, W73-11085	2K	ALLOYS A Literature Survey—Performance of Exceptional Metals in Corrosive Environments, W73-11479	8G
Lead Contamination of Snow, W73-11275	5B	Mobile Area Water Transportation Study of Mobile, Baldwin and Escambia Counties, Alabama, W73-11260	8A	ALLUVIAL FANS Scour and Fill in Tujunga Wash—A Fanhead Valley in Urban Southern California—1969, W73-11550	2J
Heavy Metals: Fallout Around a Power Plant, W73-11282	5A	Comprehensive Water Sewer Plan for Baldwin County, Alabama, W73-11261	5D	ALTERNATING CURRENTS Four Phenomena Affecting Cathodic Protection and Corrosion Rates, W73-11475	8G
Cell Systems Keep Mercury From Atmosphere, W73-11287	5G	Comprehensive Water and Sewer Plan for Escambia County, Alabama, W73-11262	5D	ALTERNATIVE PLANNING Analysis of Engineering Alternatives for Environmental Protection from Thermal Discharges, W73-11078	5G
Lead Pollution from a Factory Manufacturing Anti-Knock Compounds, W73-11290	5B	ALASKA A Principles Study of Factors Affecting the Hydrological Balance of the Lemon Glacier System and Adjacent Sectors of the Juneau Icefield, Southeastern Alaska, 1965-1969, W73-11054	2C	ALUMINUM Effects of Chemical Variations in Aquatic Environments: Volume II, Toxic effects of aqueous aluminum to rainbow trout, W73-11075	5C
Volcanic Exhalations and Metal Enrichments at Matupi Harbor, New Britain, T.P.N.G., W73-11292	5B	A Catalog of Hydroclimatological Data for Alaska's Coastal Zone, W73-11056	2B	AMINES Liquid-Liquid Extraction of Cadmium With High-Molecular-Weight Amines From Iodide Solutions, W73-11664	5A
Trace Elements in the Atmospheric Environment, W73-11299	5A	Seismic Seiches in Bays, Channels, and Estuaries, W73-11532	2H	AMINO ACIDS X-Ray Photoelectron Spectroscopy of Metals in Amino Acid Complexes and Proteins, (Rontgen-Photoelektronenspektroskopie von Metallen in Aminosäurekomplexen und Proteinen), W73-11121	5A
AIR POLLUTION EFFECTS		ALBUQUERQUE (NEW MEXICO) Supplement to City of Albuquerque Sandia Foothills Drainage Study, W73-11669	4A	AMPHIDINIUM CARTERI The Seasonal Cycle of Vitamin B12 in the Strait of Georgia, British Columbia, W73-11578	2L
Auto Exhaust - Lead Vs Aromatics, W73-11301	5A	ALGAE Evaluation of New Algicides for Water Supply Purposes, W73-11353	5F	ANALOG MODELS Electrical-Analog Model Study of a Hydrologic System in Southeast Florida, W73-11570	2A
The Heavy Metal Content of Rainfall in the East Midlands, W73-11648	5A	Helicopter Application of Copper Sulfate, W73-11419	5F	ANALYTICAL TECHNIQUES Precision and Detection Limits of Cadmium, Manganese, Cobalt, and Nickel in Sulfides by Electron Microprobe Analysis, W73-11178	5A
AIR SAMPLES		How to Black Out Algae, W73-11420	5F	Lithium in Surficial Materials of the Conterminous United States and Partial Data on Cadmium, W73-11268	5B
Areawide Trace Metal Concentrations Measured by Multielement Neutron Activation Analysis - A One Day Study in Northwest Indiana, W73-11278	5B	Taste and Odor Control - Chemicals and Methods, W73-11421	5F	Water Analysis, W73-11285	2K
AIR-SEA INTERACTIONS		Microstraining Removes Algae and Cuts Filter Back-Washing, W73-11450	5F	The Use of Atomic Absorption for Analysis of Natural Waters, W73-11291	5A
Large-Scale and Long-Term Fluctuations in some Atmospheric and Oceanic Variables, W73-11369	2B	A Quantitative, Semiroutine Method for Determining Algal and Sedimentary Chlorophyll Derivatives, W73-11637	5A		
AIR-WATER INTERFACES		A Comparison of Benthic Microalgal Production Measured by C-14 and Oxygen Methods, W73-11658	5A		
Spectra of Turbulent Fluctuations Over Ocean Waves, W73-11087	2B	60-MGD Microstraining Plant Meets Denver's Growing Needs, W73-11667	5F		
Radiation, Evaporation and the Maintenance of Turbulence under Stable Conditions in the Lower Atmosphere, W73-11345	2D	ALGAL CONTROL Two-Point Copper Sulfating Program Licks/Algae Problem, W73-11447	5F		
A Power Wind Law for Turbulent Transfer Computations, W73-11344	2D	ALGICIDES Evaluation of New Algicides for Water Supply Purposes, W73-11353	5F		
Computing Evapotranspiration by Geostrophic Drag Concept, W73-11345	2D				
Unified Formulation of Wall Turbulence, W73-11346	2D				
Sensitivity of the Solution for Heat Flux or Evaporation to Off-Diagonal Turbulent Diffusivities, W73-11347	2D				
Perturbation Solution of an Equation of Atmospheric Turbulent Diffusion, W73-11348	2D				
A Solution for Simultaneous Turbulent Heat and Vapor Transfer between a Water Surface and the Atmosphere, W73-11349	2D				

SUBJECT INDEX

ARKANSAS RIVER VALLEY (COLO)

Determination of Total Chromium in Fresh Waters by Atomic Absorption, W73-11295	AQUATIC ALGAE	Photolytically Initiated Riboflavin Chemiluminescence, W73-11636	
The Determination of Small Amounts of Mercury in Organic Matter. W73-11296	Ecology of Yellowstone Thermal Effluent Systems: Intersects of Blue-Green Algae, Grazing Flies (<i>Paracoenia, Ephyrinidae</i>) and Water Mites (<i>Partuniciella, Hydrachnellae</i>), W73-11131	5A	
Dithizon Procedure for Mercury Analysis, W73-11306	AQUATIC BACTERIA	Liquid-Liquid Extraction of Cadmium With High-Molecular-Weight Amines From Iodide Solutions, W73-11664	
Operation of the Analytical Methodology Information Center, W73-11336	Ecology of Yellowstone Thermal Effluent Systems: Intersects of Blue-Green Algae, Grazing Flies (<i>Paracoenia, Ephyrinidae</i>) and Water Mites (<i>Partuniciella, Hydrachnellae</i>), W73-11131	5C	
Ultrapurity in Trace Analysis, W73-11483	AQUATIC DRIFT	AQUIFER CHARACTERISTICS	
ANGUILLA ROSTRATA	Experiments on the Movement Behavior of Single-Cell Flowing Water Algae, (Experimente Zum Bewegungsverhalten Von Einzelligen Flesswasseralgen), W73-11626	5C	Ground-water Basic Data of Cavalier and Pemina Counties, W73-11397
Total Mercury and Methylmercury Content of the American Eel (<i>Anguilla rostrata</i>), W73-11576	AQUATIC ENVIRONMENT	Observation Boreholes—Construction and Use: Final Report of Research Panel, No. 9. W73-11466	
ANIMAL PATHOLOGY	The Role of Nitrogen in the Aquatic Environment, W73-11640	8A	
Transfer of Metallic Mercury into the Foetus, W73-11274	Sampling Procedures and Problems in Determining Pesticide Residues in the Hydrologic Environment, W73-11660	4B	
ANIMAL TISSUES	AQUATIC INSECTS	Artificial Recharge in the Whitewater River Area, Palm Springs, California, W73-11565	
Mercury in Harbour Porpoises (<i>Phocoena phocoena</i>) From the Bay of Fundy Region, W73-11588	Effects of Chemical Variations in Aquatic Environments: Volume I, Biota and Chemistry of Picance Creek, W73-11074	2A	
Effects of a 12-Hr and 25-Day Exposure to Kraft Pulp Mill Effluent on the Blood and Tissues of Juvenile Coho Salmon (<i>Oncorhynchus kisutch</i>), W73-11620	Fish and Food Organisms in Acid Mine Waters of Pennsylvania, W73-11332	2F	
ANION EXCHANGE	A Centrifuge Method for Determining Live Weights of Aquatic Insect Larvae, with a Note on Weight Loss in Preservative, W73-11647	5C	
Anion Exchange Separations of the Elements Extractable with Tributyl Phosphate. IV, (Anionenaustauschuntersuchungen der Mit Tributylphosphat Extrahierbaren Elemente. IV), W73-11122	AQUATIC MICROORGANISMS	AQUIFERS	
2,4,6-Triphenylpyrylium Chloride. A New Organic Analytical Reagent for the Determination of Certain Anions, W73-11623	Microbial Activity as a Biogeochemical Factor in the Ocean, W73-11378	Behavior of Groundwater Flow Subject to Time-Varying Recharge, W73-11142	
ANISOTROPY	AQUATIC PLANTS	Availability of Groundwater for Public-Water Supply in Central and Southern Escambia County, Florida: Interim Report, July 1972, W73-11563	
Pore Pressure Measurements in Acelotropic Peat, W73-11195	Mercury Accumulation by <i>Myriophyllum Spicatum L.</i> , W73-11168	2F	
ANKISTRODESMUS BRAUNII	Recovery of Salt Marsh Vegetation From Successive Oil Spillages, W73-11649	5B	
The Influence of Simazine on the Photosynthetic Pigments of Green Algae, W73-11610	AQUEOUS SOLUTIONS	ARABIA	
ANODES	Survey of Application of Radiation to Preparative Chemistry, W73-11119	The Classification of Arid Zone Soils: II. The Classification of Sedosols in South Arabia, W73-11418	
Design and Installation of Deep Anode Groundbeds, W73-11480	Volumetric Determination of Nickel by High Frequency Impedimetry, W73-11127	2G	
ANODIC STRIPPING VOLTAMMETRY	Removal of Mercury from Aqueous Solutions by Nitrogen-Containing Chemically Modified Cotton, W73-11174	ARC WELDING	
Anodic Stripping Voltammetry at a Tubular Mercury-Covered Graphite Electrode, W73-11484	ARCTIC	All-Position Production Welding with Flux-Cored Gas-Shielded Electrodes, W73-11501	
ANTIBIOTICS	AQUATIC PLANTS	Seasonal Emergence of Some High Arctic Chironomidae (Diptera), W73-11148	
Evaluation of New Algicides for Water Supply Purposes, W73-11353	Survey of Application of Radiation to Preparative Chemistry, W73-11119	2I	
APPLICATION EQUIPMENT	Volumetric Determination of Nickel by High Frequency Impedimetry, W73-11127	Crude Oil Behavior on Arctic Winter Ice, W73-11539	
Operation and Capability of the Becker Hammer Drill, W73-11470	Removal of Mercury from Aqueous Solutions by Nitrogen-Containing Chemically Modified Cotton, W73-11174	5B	
	AQUEOUS SOLUTIONS	ARID LANDS	
	Spectrophotometric Method for Determination of Ozone in Aqueous Solutions, W73-11495	Analysis of Soil Temperatures in the Arid Zone of India by Fourier Techniques, W73-11177	
	Selective Determination of Copper (II) In Aqueous Media by Enhancement of Flash-	ARKANSAS	
		Fluvial Sediment in Sixmile Creek Subwatershed 6, Near Chismville, Arkansas, W73-11082	
		Water Resources of Hempstead, Lafayette, Little River, Miller, and Nevada Counties, Arkansas, W73-11222	
		4B	
		ARKANSAS RIVER VALLEY (COLO)	
		Stream Depletion Factors, Arkansas River Valley, Southeastern Colorado: A Basis for Evaluating Plans for Conjunctive Use of Ground and Surface Water, W73-11221	
		4B	

SUBJECT INDEX

AROMATIC AMINES

AROMATIC AMINES
Determination of Phenols and Aromatic Amines by Direct Titration with Bromine in Propylene Carbonate,
W73-11485 5A

AROMATIC COMPOUNDS

Auto Exhaust - Lead Vs Aromatics,
W73-11301 5A

ARSENIC

Arsenic in the Lipid Extracts of Marine Invertebrates,
W73-11189 5C

Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish,
W73-11279 5B

ARSENIC COMPOUNDS

Arsenic in the Lipid Extracts of Marine Invertebrates,
W73-11189 5C

ARTESIAN WELLS

The Biggest Artesian Well in the World,
W73-11481 8A

ARTHROPODS

Ecology of Yellowstone Thermal Effluent Systems: Intersects of Blue-Green Algae, Grazing Flies (Paracoenia, Ephydriidae) and Water Mites (Partunicia, Hydrachnellae),
W73-11131 5C

ARTIFICIAL RECHARGE

Artificial Recharge of Groundwater, A Bibliography,
W73-11321 4B

Artificial Recharge in the Whitewater River Area, Palm Springs, California,
W73-11565 4B

ASHUELLOT RIVER (N.H.)

Linear Programming use for Evaluating Water Resources and Cost and Benefit Allocation,
W73-11683 6A

ASPERGILLUS spp

Application of the Fluorescent Antibody Technique to the Differentiation of Aspergillus Species, Candida Species and Zygomycetes in Paraffin Section of Formalin-Fixed Tissues,
W73-11126 5A

ASSAY

Effects of Chemical Variations in Aquatic Environments: Volume III, Lead Toxicity to Rainbow Trout and Testing Application Factor Concept,
W73-11076 5C

ASSIMILATION

Nitrogen and Phosphorus Uptake by Chlorella pyrenoidosa in Sewage Treatment Processes,
W73-11617 5B

ATLANTIC OCEAN

Hydrographic Study of the Shelf and Slope Waters of New York Bight,
W73-11110 2E

Chlorinated Hydrocarbons in Open-Ocean Atlantic Organisms,
W73-11377 5B

Sedimentation in the Deep-Sea Areas Adjacent to the Canary and Cape Verde Islands,
W73-11393 2J

Sediments in the Atlantic Corner Seamounts: Control by Topography, Paleo-Winds, and Geochemically-Detected Modern Bottom Currents,
W73-11394 2J

ATMOSPHERE

Response of Relative Water Content in Zea Mays L. to Changes of Potential in the Rhizosphere and Atmosphere,
W73-11145 3F

The Inference of Atmospheric Ozone Using Satellite Nadir Measurements in the 1042/CM Band,
W73-11400 7B

ATMOSPHERIC CORROSION

Corrosion of Metals in Tropical Environments—Copper and Wrought Copper Alloys,
W73-11455 8G

ATOMIC ABSORPTION SPECTROPHOTOMETRY

The Occurrence and Seasonal Variation of Trace Metals in the Scallops *Pecten maximus* (L.) and *Chlamys opercularis* (L.),
W73-11624 5A

ATOMIC ABSORPTION SPECTROSCOPY

Water Analysis,
W73-11285 2K

Sea Fish Contamination With Mercury (Contamination des poissons de mer par le mercure),
W73-11289 5C

The Use of Atomic Absorption for Analysis of Natural Waters,
W73-11291 5A

Atomic Absorption Spectrophotometry as a Tool for the Water Chemist,
W73-11294 5A

Determination of Total Chromium in Fresh Waters by Atomic Absorption,
W73-11295 5A

Determination of Trace Mercury in Soil and Rock Media,
W73-11297 5A

Atomic Absorption Spectrophotometry in the Field of Marine Research,
W73-11298 5A

Lead Emissions from Incinerated Sewage Sludge Detected on Tree Foliage,
W73-11302 5A

ATTITUDES

Toward a Philosophy of Planning: Attitudes of Federal Water Planners,
W73-11073 6A

AUSTRALIA

Sediment Records of the Snowy Mountains Region, Australia,
W73-11572 2J

AUSTRALIA (MT. CRAWFORD)

The Effect of Environmental Factors on Wood Characteristics: I. The Influence of Irrigation on *Pinus Radiata* from South Australia,
W73-11452 4A

AUTOMATIC CONTROL

Clean-Up of Crude Extracts Containing Pesticide Residues by an Automatic Apparatus Bas-

ing Upon the Principle of 'Sweep Co-Distillation', (Reinigung Pesticiddruckstande Enthalgender Rohextrakte Mit Einer Automatisch Arbeitenden Apparatur Nach Dem Prinzip der Kombinierten Spülund Codestillation (Sweep Codistillation)),
W73-11124 5A

Low Cost Multichannel Scanning pH-Stat,
W73-11492 5A

AUTOMATION
Filter Washing Goes Modern,
W73-11448 5F

Rotary Rig Due for Face-Lifting,
W73-11459 8B

Gas Chromatograph Peaks Identified On-Line by a New Grating Infrared Spectrophotometer,
W73-11609 5A

AUTOMOBILE EXHAUSTS

Auto Exhaust - Lead Vs Aromatics,
W73-11301 5A

AVERAGE FLOW

Minimum Flow in the Iberian Peninsula (Minimal'nyy stok rek Pireneyskogo polusostrova),
W73-11098 2E

BACKGROUND LEVEL

Application of Regression Analysis to the Study of Background Variations in Trace Metal Content of Stream Sediments,
W73-11179 5A

BACKWASHING

Filter Washing Goes Modern,
W73-11448 5F

Design Factors for Effective Settling of Coagulated Water,
W73-11451 5F

BACTERIA

Oxidation of Copper (II) Selenide by Thiobacillus Ferrooxidans,
W73-11171 5C

Volatilization of Mercuric Chloride by Mercury-Resistant Plasmid-Bearing Strains of *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*,
W73-11286 5B

Tropical Role of Bacteria in the Ecosystem of the Coral Reef,
W73-11632 5A

BALDWIN COUNTY (ALA)

Mobile Area Water Transportation Study of Mobile, Baldwin and Escambia Counties, Alabama,
W73-11260 5A

Comprehensive Water Sewer Plan for Baldwin County, Alabama.
W73-11261 5D

BALDWIN HILLS RESERVOIR (CALIF)

Ground Rupture in the Baldwin Hills,
W73-11206 5E

BALTIMORE HARBOR

Sublethal Effects of Baltimore Harbor Water on the White Perch, *Morone americana*, and the Hogchoker, *Trinectes maculatus*,
W73-11652 5C

SUBJECT INDEX

BIOASSAY

BARIUM CARBONATE		
Softening of Sea Water By Addition of Barium Carbonate and CO ₂ , W73-11236	5F	
BARRIERS		
Control of Hazardous Chemical Spills by Physical Barriers, W73-11338	5G	
BASIC DATA COLLECTIONS		
Groundwater Data in the Corvallis-Albany Area, Central Willamette Valley, Oregon, W73-11093	4B	
Water Records of the U.S. Virgin Islands, 1962-69, W73-11396	2E	
An Investigation of Floods in Hawaii Through September 30, 1972, W73-11404	2E	
BATHYMETRY		
Bathymetric Reconnaissance of Wild Horse Reservoir, Elko County, Nevada, W73-11219	7C	
Bathymetric Reconnaissance of Weber Reservoir, Mineral County, Nevada, W73-11220	7C	
Research and the Problems of Two Seas, W73-11350	2L	
Bathymetric Reconnaissance of Lake Tahoe, Nevada and California, W73-11531	2H	
BATHYTHERMOGRAPHY		
Circulation Patterns in Lake Superior, W73-11342	2H	
BAYS		
Characteristics and Environmental Quality of Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York, W73-11108	2K	
Survey of Water Quality and Sediments in Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York (Appendix to Technical Report No. 14), W73-11109	2K	
Research and the Problems of Two Seas, W73-11350	2L	
A Water-Quality Simulation Model for Well-Mixed Estuaries and Coastal Seas: Vol. V, Jamaica Bay Rainstorms, W73-11351	5B	
Sand Movement Along Carmel River State Beach, Carmel, California, W73-11557	2L	
BEACH EROSION		
Onshore-Offshore Sand Transport on Del Monte Beach, California, W73-11086	2J	
Ecological Monitoring of Two Beach Nourishment Projects in Broward County, Florida, W73-11528	2J	
Sand Movement Along Carmel River State Beach, Carmel, California, W73-11557	2L	
BEACHES		
Sand Transport by the Eel River and Its Effect on Nearby Beaches, W73-11559	2L	
BEAMS (STRUCTURAL)		
Torsional Stiffness of Reinforced Concrete Members Subjected to Pure Torsion, W73-11519	8F	
BEARING STRENGTH		
Behaviour of Fine Sands and Silts During the Rise of Ground-Water Level, W73-11194	2G	
BEDS (STRATIGRAPHIC)		
Location and Determination of Depths of Sub-surface Undulations by Seismic Methods, W73-11398	8E	
BELGIUM (DIEVENGAL)		
Partitioning of a Brackish Water Habitat by Copepod Species, W73-11130	5A	
BENTHIC FAUNA		
Pollution as a Result of Fish Cultural Activities, W73-11077	5B	
Macrobenthic Ecology of a Sawdust-Bearing Substrate in the Penobscot River Estuary (Maine), W73-11602	5C	
BENTHIC FLORA		
A Comparison of Benthic Microalgal Production Measured by C-14 and Oxygen Methods, W73-11658	5A	
BERING SEA		
Physical-Chemical Oceanographic Data from the North Pacific Ocean and Bering Sea, 1971, W73-11595	5A	
BIBLIOGRAPHIES		
Housing and Planning References, W73-11251	3D	
Water Analysis, W73-11285	2K	
Phosphorus Removal, A Bibliography, Volume I, W73-11319	5D	
Phosphorus Removal, A Bibliography, Volume 2, W73-11320	5D	
Artificial Recharge of Groundwater, A Bibliography, W73-11321	4B	
Operation of the Analytical Methodology Information Center, W73-11336	5A	
BIGHORN LAKE		
Limnology of Yellowtail Reservoir and the Big Horn River, W73-11331	5C	
BIOACCUMULATION		
The Accumulation from Water of ZN-65, MN-54, CO-58, and FE-59 by the Mussel, <i>Mytilus edulis</i> , W73-11625	5A	
Cycling of Elements of Estuaries, W73-11645	5B	
BIOASSAY		
Temperature Effects on Mercury Accumulation, Toxicity, and Metabolic Rate in Rainbow Trout (<i>Salmo gairdneri</i>), W73-11655	5C	
BIOASSAY		
Plant Analysis for Nutrient Assay of Natural Waters, W73-11057	5C	
Effects of Chemical Variations in Aquatic Environments: Volume III, Lead Toxicity to Rainbow Trout and Testing Application Factor Concept, W73-11076	5C	
A Continuous-Flow Apparatus for Assessing the Toxicity of Substances to Marine Animals, W73-11169	5C	
Trace Metal Content of Hair, I. Zinc and copper Content of Human Hair in Relation to Age and Sex, W73-11308	5A	
Fish and Food Organisms in Acid Mine Waters of Pennsylvania, W73-11332	5C	
Standard Dispersant Effectiveness and Toxicity Tests, W73-11442	5A	
The Seasonal Cycle of Vitamin B12 in the Strait of Georgia, British Columbia, W73-11578	2L	
Acute and Long-Term Accumulation of Copper by the Brown Bullhead, <i>Ictalurus nebulosus</i> , W73-11593	5C	
A Cyprinodont Fish, <i>Jordanella floridae</i> , as a Laboratory Animal for Rapid Chronic Bioassays, W73-11598	5C	
Sublethal Effects of Bleached Kraft Pulp Mill Effluent on Respiration and Circulation in Sockeye Salmon (<i>Oncorhynchus nerka</i>), W73-11615	5C	
Copper Induced Lesions in Estuarine Teleosts, W73-11616	5C	
Response of Lobsters <i>Homarus americanus</i> to Odor Solution in The Presence of Bleached Kraft Mill Effluent, W73-11619	5C	
Effects of a 12-Hr and 25-Day Exposure to Kraft Pulp Mill Effluent on the Blood and Tissues of Juvenile Coho Salmon (<i>Oncorhynchus kisutch</i>), W73-11620	5C	
Survival and Gill Condition of Bluegill (<i>Lepomis macrochirus</i>) and Fathead Minnows (<i>Pimephales promelas</i>) Exposed to Sodium Nitrotriacetate (NTA) for 28 Days, W73-11621	5C	
The Occurrence and Seasonal Variation of Trace Metals in the Scallops <i>Pecten maximus</i> (L.) and <i>Chlamys opercularis</i> (L.), W73-11624	5A	
The Accumulation from Water of ZN-65, MN-54, CO-58, and FE-59 by the Mussel, <i>Mytilus edulis</i> , W73-11625	5A	

SUBJECT INDEX

BIOASSAY

Influence of Lead and Other Metals on Fish
Delta-Aminolevulinate Dehydrase Activity,
W73-11646 5A

Low pH Values Shown to Affect Developing
Fish Eggs (Brachydanio rerio Ham.-Buch.),
W73-11651 5C

Sublethal Effects of Baltimore Harbor Water
on the White Perch, Morone americana, and
the Hogchoker, Trinectes maculatus,
W73-11652 5C

Temperature Effects on Mercury Accumulation,
Toxicity, and Metabolic Rate in Rainbow
Trout (Salmo gairdneri),
W73-11655 5C

Effects of Sublethal Concentrations of Sodium
Pentachlorophenate on Growth Rate, Food
Conversion Efficiency, and Swimming Perfor-
mance in Underyearling Sockeye Salmon
(Oncorhynchus nerka),
W73-11656 5C

BIOCHEMICAL OXYGEN DEMAND
Accelerated Biological-Chemical Wastewater
Treatment,
W73-11229 5D

Nonlinear Parameter Estimation in Water
Quality Modeling,
W73-11361 5B

BOD: Determining the Necessary Dilution
Technique,
W73-11661 5A

BIOCHEMISTRY
Microbial Activity as a Biogeochemical Factor
in the Ocean,
W73-11378 5B

Biodegradation
Microbial Activity as a Biogeochemical Factor
in the Ocean,
W73-11378 5B

BIOINDICATORS
Investigations into the Occurrence of Coliform
Organisms from Pristine Streams,
W73-11428 5B

Pollution Effects on Phycovirus and Host
Algae Ecology,
W73-11635 5C

BIOLOGICAL COMMUNITIES
Study of the Changes in the Structure of Two
Algal Populations: An R-Type Factor Analysis,
W73-11129 5A

BIOLOGICAL MAGNIFICATION
Temperature Effects on Mercury Accumulation,
Toxicity, and Metabolic Rate in Rainbow
Trout (Salmo gairdneri),
W73-11655 5C

BIOLOGICAL MATERIALS
Determination of Nitrogen, Sulfur,
Phosphorus, and Carbon in Solid Biological
Materials via Hydrogenation and Element
Selective Detection,
W73-11606 5A

BIOLOGICAL SAMPLES
Determination of Mercury Contents in Diverse
Samples of Fish and Other Biological Materials
by Neutron Activation Analysis, (Neutronenak-
tivierungsanalytische Bestimmungen von

Quecksilbergehalten in Diversen Fischproben
und Anderen Biologischen Materialien),
W73-11123 5A

DDT, DDE, and Polychlorinated Biphenyls in
Biota From the Gulf of Mexico and Caribbean
Sea-1971,
W73-11580 5B

Dursban (Trademark) and Diazinon Residues in
Biota Following Treatment of Intertidal Plots
on Cape Cod - 1967-69,
W73-11627 5C

BIOLOGICAL TREATMENT

Cannery Wastewater Treatment with Rotating
Biological Contactor and Extended Aeration,
W73-11058 5D

Accelerated Biological-Chemical Wastewater
Treatment,
W73-11229 5D

Biological Removal of Carbon and Nitrogen
Compounds from Coke Plant Wastes,
W73-11328 5D

BIOASSAY

Tropical Role of Bacteria in the Ecosystem of
the Coral Reef,
W73-11632 5A

BIOTA

Effects of Chemical Variations in Aquatic En-
vironments: Volume I, Biota and Chemistry of
Picance Creek,
W73-11074 5C

BIOTRANSFORMATION

The Role of Nitrogen in the Aquatic Environ-
ment,
W73-11640 5C

Cycling of Elements of Estuaries,
W73-11645 5B

BIS-2

Mass Spectrometric Identification of Some bis-
2,4-Dinitrophenylhydrazones,
W73-11487 5A

BITUMINOUS CONCRETES

Bituminous Blanket for Dike at Ludington
Pumped Storage Project,
W73-11504 8F

BITUMINOUS MATERIALS

Bituminous Blanket for Dike at Ludington
Pumped Storage Project,
W73-11504 8F

BLACK SEA

Role of Iron Sulfides in the Accumulation of
Trace Elements in Black Sea Sediments (Rol'
sul'fidov zhelezna pri nakoplenii mikroelementov v osadkakh Chernogo morya),
W73-11409 2J

Conditions of Preservation of Chlorophyll,
Pheophytin, and Humic Substances in Black
Sea Sediments (Usloviya sokhranosti
khlorofilla, feofitina i guminovykh veshchestv
v otlozheniyakh Chernogo morya),
W73-11411 2J

BLANCHING

Low Water Volume Enzyme Deactivation of
Vegetables Before Preservation,
W73-11330 5D

BLANKS

Ultrapurity in Trace Analysis,
W73-11483

5A

BLEACHED KRAFT MILL EFFLUENT

Sublethal Effects of Bleached Kraft Pulp Mill
Effluent on Respiration and Circulation in
Sockeye Salmon (Oncorhynchus nerka),
W73-11615

5C

Response of Lobsters Homarus americanus to
Odor Solution in the Presence of Bleached
Kraft Mill Effluent,
W73-11619

5C

BLOOD

Effects of a 12-Hr and 25-Day Exposure to
Kraft Pulp Mill Effluent on the Blood and Tis-
sues of Juvenile Coho Salmon (Oncorhynchus
kisutch),
W73-11620

5C

BOATS

Using Fire Streams With a Self-Propelled Oil
Spill Skimmer,
W73-11434

5G

Use of Fire Streams to Control Floating Oil,
W73-11435

5G

BODIES OF WATER

The Thermal Conductivity of Pure Water and
Standard Sea Water as a Function of Pressure
and Temperature: Part II--Pure Water,
W73-11084

2K

BOHEMIA (CZECHOSLOVAKIA)

Influence of Weathering on Effective Values of
Shear Strength of Miocene Clay,
W73-11196

2K

BOILING

Tube Identifier,
W73-11155

3A

BOILING POINT

Simulated Distillation of Narrow, High Boiling
Hydrocarbon Fractions,
W73-11613

5A

BOOM TERMINAL GAP

Shore Termination for Oil Spill Booms,
W73-11437

5G

BOOMING

Using Fire Streams With a Self-Propelled Oil
Spill Skimmer,
W73-11434

5G

BOOMS

Shore Termination for Oil Spill Booms,
W73-11437

5G

A Rapidly Deployable Oil Containment Boom
for Emergency Harbor Use,
W73-11439

5G

BOREHOLES

Observation Boreholes--Construction and Use:
Final Report of Research Panel, No. 9.
W73-11466

8A

BOTTOM SEDIMENTS

Neutron Activation Analysis of Bottom Sedi-
ments,
W73-11067

5A

Phosphate in Interstitial Waters of Anoxic
Sediments: Oxidation Effects During Sampling
Procedure,
W73-11118

5B

SUBJECT INDEX

CAPE VERDE ISLANDS

Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material, W73-11339	5A	CADDISFLIES Biological Effects of Fluctuating Water Levels in the Snake River, Grand Teton National Park, Wyoming, W73-11594	2E	Nonlinear Parameter Estimation in Water Quality Modeling, W73-11361	5B
Manganese Nodules and Budget of Trace Solubles in Oceans, W73-11384	5B	CADMIUM Lithium in Surficial Materials of the Contiguous United States and Partial Data on Cadmium, W73-11268	5B	Ecological and Physiological Implications of Greenbelt Irrigation - Phase I, W73-11424	5D
Sediments in the Atlantic Corner Seamounts: Control by Topography, Paleo-Winds, and Geochemically-Detected Modern Bottom Currents, W73-11394	2J	Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish, W73-11279	5B	Hydrology of Truckee Meadows, Nevada, W73-11430	4B
Multi-Element Neutron Activation Analysis of Sediment Using a Californium-252 Source, W73-11644	5A	A Few Coastal Pollution Problems in Japan, W73-11376	5C	Wetting Requirements to Improve Collapsing Foundation Soils, W73-11526	8D
BRACKISH WATER		The Occurrence and Seasonal Variation of Trace Metals in the Scallops <i>Pecten maximus</i> (L.) and <i>Chlamys opercularis</i> (L.), W73-11624	5A	Scour and Fill in Tujunga Wash-A Fanhead Valley in Urban Southern California-1969, W73-11550	2J
Direct Determination of the Electromagnetic Reflection Properties of Smooth Brackish Water to the Continuous Spectrum from 100 million to 4 billion Hertz, W73-11052	2L	Liquid-Liquid Extraction of Cadmium With High-Molecular-Weight Amines From Iodide Solutions, W73-11664	5A	Sand Movement Along Carmel River State Beach, Carmel, California, W73-11557	2L
Partitioning of a Brackish Water Habitat by Copepod Species, W73-11130	5A	CALCIFICATION Carbon Dioxide Dynamics: A Record of Organic Carbon Production, Respiration, and Calcification in the Eniwetok Reef Flat Community, W73-11488	5A	Sand Transport by the Eel River and Its Effect on Nearby Beaches, W73-11559	2L
BREAKWATERS		CALCITE Calcite Saturation in an Eastern Kentucky Karst Stream, W73-11391	2K	Artificial Recharge in the Whitewater River Area, Palm Springs, California, W73-11565	4B
Analysis of Lake Erie Wave Pressure Data, W73-11548	8B	CALIFORNIA Onshore-Offshore Sand Transport on Del Monte Beach, California, W73-11086	2J	CALMEN-252 Multi-Element Neutron Activation Analysis of Sediment Using a Californium-252 Source, W73-11644	5A
BRIDGE DESIGN		A Case History of Santa Cruz Harbor, California, W73-11092	8B	CAMBER A Probabilistic Approach to Maximum Column Strength, W73-11516	8A
Designing to Prevent Brittle Fractures in Bridges, W73-11525	8G	Programing Model for Evaluating Economic and Financial Feasibility of Irrigation Projects with Extended Development Periods, W73-11149	3F	CANADA Remote Sensing Evaluation of Environmental Factors Affecting the Developmental Capacity of Inland Lakes, W73-11540	7B
BRIDGE FAILURE		Ground Rupture in the Baldwin Hills, W73-11206	5E	CANADA (ONTARIO) Parasites of Fish from Lake of the Woods, Ontario, W73-11172	2I
Designing to Prevent Brittle Fractures in Bridges, W73-11525	8G	The Use of Ocean Tide Records to Detect Motions Premonitory to a Tectonic Event in the Long Beach, California Area, W73-11214	7B	CANALS Electrical-Analog Model Study of a Hydrologic System in Southeast Florida, W73-11570	2A
BROMINE		Urbanization's Drainage Consequence, W73-11254	4C	CANDIDA SPP Application of the Fluorescent Antibody Technique to the Differentiation of Aspergillus Species, <i>Candida</i> Species and Zygomycetes in Paraffin Section of Formalin-Fixed Tissues, W73-11126	5A
Determination of Phenols and Aromatic Amines by Direct Titration with Bromine in Propylene Carbonate, W73-11485	5A	Public Participation in Urban Water Planning, W73-11257	6B	CANNERIES Cannery Wastewater Treatment with Rotating Biological Contactor and Extended Aeration, W73-11058	5D
BROWN BULLHEAD		Diurnal Variation of Aerosol Trace Element Concentrations in Livermore, California, W73-11277	5B	CANNING (FOOD PROCESSING) Low Water Volume Enzyme Deactivation of Vegetables Before Preservation, W73-11330	5D
Acute and Long-Term Accumulation of Copper by the Brown Bullhead, <i>Ictalurus Nebulosus</i> , W73-11593	5C	Mercury in the Marine Environment: Concentration in Sea Water and in a Pelagic Food Chain, W73-11300	5C	CAPE HENlopen (DEL) Hydraulic Model Measurements of Tidal Currents Around Cape Henlopen, Delaware, W73-11203	2L
BROWN TROUT		Possibility of Reducing Nitrogen in Drainage Water By On Farm-Practices, (Bio-Engineering Aspects of Agricultural Drainage, San Joaquin Valley, California). W73-11324	5B	CAPE VERDE ISLANDS Sedimentation in the Deep-Sea Areas Adjacent to the Canary and Cape Verde Islands, W73-11393	2J
The Food of Brown Trout in Llyn Alaw, Anglesey, North Wales, W73-11354	2I				
BUOYS					
Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering, W73-11631	5A				
BURMA (RANGOON)					
The Bacteriology of the Water Supplies of Rangoon: II. Cool Dry and Hot Dry Seasons, W73-11630	5C				
BURNING					
Watershed Research, W73-11534	2A				

SUBJECT INDEX

CAPILLARY WATER

CAPILLARY WATER
Capillary-Diffusion and Self-Diffusion of Liquid Water in Unsaturated Soils, W73-11390 2G

CARBOHYDRATES

Determination of Carbohydrate in Lake Sediment by a Modified Phenol-Sulfuric Acid Method, W73-11482 5A

CARBON

Biological Removal of Carbon and Nitrogen Compounds from Coke Plant Wastes, W73-11328 5D

Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection, W73-11606 5A

A Comparison of Benthic Microalgal Production Measured by C-14 and Oxygen Methods, W73-11658 5A

CARBON CYCLE

The Role of the Oceans and Biosphere in the Carbon Dioxide Cycle, W73-11373 2K

CARBON DIOXIDE

Softening of Sea Water By Addition of Barium Carbonate and CO₂, W73-11236 5F

The Role of the Oceans and Biosphere in the Carbon Dioxide Cycle, W73-11373 2K

Carbon Dioxide Dynamics: A Record of Organic Carbon Production, Respiration, and Calcification in the Eniwetok Reef Flat Community, W73-11488 5A

CARBON DIOXIDE CYCLE

The Role of the Oceans and Biosphere in the Carbon Dioxide Cycle, W73-11373 2K

CARMEL RIVER STATE BEACH (CALIF)

Sand Movement Along Carmel River State Beach, Carmel, California, W73-11557 2L

CARP

'Benduvala,' A Special Gear for Catching Major Carp Labeo Fimbriatus (Bloch) in Godavari River, with Observations on 'Benduvala' Fishery at Dummagudem, W73-11405 8I

CARTERS LAKE (GA)

Pumpoundment Study, Carters Lake. W73-11530 6G

CARTWRIGHT BASIN (TENN)

Physical Erosion and Denudation Rates in Cartwright Basin and Vicinity, Williamson County, Tennessee, W73-11140 2J

CATHODIC PROTECTION

Highly Resistant Copper Deteriorates in Severely Corrosive Soils, W73-11454 8G

Cathodic Protection--Theory and Practice in the Water Industry, W73-11472 8A

Four Phenomena Affecting Cathodic Protection and Corrosion Rates, W73-11475 8G

Cathodic Protection--The Answer to Corrosion Prevention of Underground Structures, W73-11477 8G

CATION EXCHANGE

Cation Exchange Separation of Metal Ions With Potassium Chloride-Chelating Agent-Organic Solvent Medium, W73-11311 5A

Cavalier and Pembina Counties (NDAK)

Ground-water Basic Data of Cavalier and Pembina Counties, W73-11397 4B

CELLULOSE ACETATE

The Mechanism of Formation of 'Skinned' Type Membranes and Their Characterization, W73-11153 3A

CENTRIFUGATION

Centrifugal Distillation System, W73-11223 3A

CERATOPHYLLUM DEMURSUM

Plant Analysis for Nutrient Assay of Natural Waters, W73-11057 5C

CHANNEL IMPROVEMENT

Study for Improvement of Monte Sano Bayou from Airline Highway to Mississippi River East Branch Rouge Parish, Louisiana. W73-11682 8A

CHANNEL IMPROVEMENTS

Urbanization's Drainage Consequence, W73-11254 4C

CHANNEL MORPHOLOGY

Problem of the Influence of Shape of Channel Cross Section on Velocity Distribution in a Uniform Turbulent Flow (K voprosu o vliyaniyu formy secheniya riusa na raspredeleniye skorostey v ravnomernom turbulentnom potokе), W73-11408 8B

CHARGE-MOSAIC MEMBRANES

Research on Piezodialysis, Third Report, W73-11154 3A

CHARLES RIVER BASIN

Qualitative Values in Environmental Planning: A Study of Resource Use in Urbanizing Watersheds, W73-11253 5G

CHATTahoochee River (Georgia)

Multilevel Control of Multipollutant System, W73-11363 5G

CHELATION

Cation Exchange Separation of Metal Ions With Potassium Chloride-Chelating Agent-Organic Solvent Medium, W73-11311 5A

2,3-Dihydroxynaphthalene as Indicator for the Complexometric Titration of Iron (III) with EDTA, W73-11641 5A

CHEMICAL ANALYSIS

Water Resources Data for Alabama, 1970: Part 2. Water Quality Records. W73-11085 2K

Tritium Concentration of a Variety of Water Samples: Fifth Listing, W73-11104 5B

Water Quality Investigations: Souris River Basin, North Dakota, 1969, W73-11115 5B

Application of Radiochemical Methods in Environmental Research, (Anwendung Radiochemischer Methoden in der Umweltforschung), W73-11125 5A

Water Sampling Guidelines and Interpretation of Data, W73-11205 7A

Determination of Carbohydrate in Lake Sediment by a Modified Phenol-Sulfuric Acid Method, W73-11482 5A

Total Mercury and Methylmercury Content of the American Eel (Anguilla rostrata), W73-11576 6C

Mercury in Harbour Porpoises (*Phocoena phocoena*) From the Bay of Fundy Region, W73-11588 5C

Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection, W73-11606 5A

Pesticides in Water, W73-11618 5B

2,4,6-Triphenylpyrylium Chloride. A New Organic Analytical Reagent for the Determination of Certain Anions, W73-11623 5A

Organochlorine Insecticides in Surface Waters in Germany-1970 and 1971, W73-11628 5C

Multi-Element Neutron Activation Analysis of Sediment Using a Californium-252 Source, W73-11644 5A

The Heavy Metal Content of Rainfall in the East Midlands, W73-11648 5A

Chemical and Biological Quality of Municipal Sludge, W73-11679 5E

CHEMICAL COMPOSITION

Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection, W73-11606 5A

Identification of the Constituents of Kraft Pulp Effluent That are Toxic to Juvenile Coho Salmon (*Oncorhynchus kisutch*), W73-11638 5A

CHEMICAL DEGRADATION

A Study of the Photodegradation of Commercial Dyes, W73-11325 5B

CHEMICAL INDICATORS

2,3-Dihydroxynaphthalene as Indicator for the Complexometric Titration of Iron (III) with EDTA, W73-11641 5A

SUBJECT INDEX

CLAMS

CHEMICAL INTERFERENCE	
Ultrapurity in Trace Analysis, W73-11483	5A
A Solvent Extraction Method for the Determination of Phosphorus-32 in Sea Water, W73-11643	5A
CHEMICAL OXYGEN DEMAND	
A Colorimetric Technique Suggested for Chemical Oxygen Demand Determination, W73-11599	5A
Chemical Oxygen Demand of Some Nitrogenous Heterocyclic Compounds, W73-11611	5A
CHEMICAL PRECIPITATION	
Accretion Rates of Freshwater Manganese Deposits, W73-11088	2J
CHEMICAL REACTIONS	
Survey of Application of Radiation to Preparative Chemistry, W73-11119	2K
Process for the Removal of Cyanide from Sewage by Means of Formaldehyde, W73-11224	5D
Chemical Oxygen Demand of Some Nitrogenous Heterocyclic Compounds, W73-11611	5A
CHEMICAL RECOVERY	
A Solvent Extraction Method for the Determination of Phosphorus-32 in Sea Water, W73-11643	5A
CHEMICAL TREATMENT	
Process for the Removal of Cyanide from Sewage by Means of Formaldehyde, W73-11224	5D
Accelerated Biological-Chemical Wastewater Treatment, W73-11229	5D
Apparatus for Treating Sewage, W73-11231	5D
Water Decomposition Apparatus, W73-11234	5F
Purification of Waste Water, W73-11238	5D
CHEMICALS	
Handbook of Toxic Chemicals (Second Edition, Revised and Supplemented), W73-11554	5C
CHEMILUMINESCENCE	
Selective Determination of Copper (II) In Aqueous Media by Enhancement of Flash-Photolytically Initiated Riboflavin Chemiluminescence, W73-11636	5A
CHESAPEAKE BAY	
Phosphate in Intertidal Waters of Anoxic Sediments: Oxidation Effects During Sampling Procedure, W73-11118	5B
CHICAGO	
Construction Difficulty Index for Tunnel Construction, W73-11681	8H
CHICAGO (ILL)	
Chemical and Biological Quality of Municipal Sludge, W73-11679	5E
CHIRONOMIDAE	
Seasonal Emergence of Some High Arctic Chironomidae (Diptera), W73-11148	2I
CHLOR-ALKALI INDUSTRY	
Chlorine Makers Clutch at Last Drops of Mercury. W73-11288	5D
CHLORELLA PYRENOIDOSA	
Nitrogen and Phosphorus Uptake by Chlorella pyrenoidosa in Sewage Treatment Processes, W73-11617	5B
CHLORELLA VULGARIS	
The Influence of Simazine on the Photosynthetic Pigments of Green Algae, W73-11610	5C
CHLORIDES	
Simultaneous Transport of Chloride and Water During Infiltration, W73-11213	2K
Recover Zinc From Zinc Ash, W73-11281	5D
CHLORINATED HYDROCARBON PESTICIDES	
Adsorption of Chlorinated Hydrocarbons from Seawater by a Crosslinked Polymer, W73-11443	5A
Residues of Chlorinated Hydrocarbon Pesticides in the Northern Quahog (Hard-Shell Clam), Mercenaria mercenaria-1968 and 1969, W73-11579	5C
Trace Analysis by Enzyme Inhibition and Activation, W73-11604	5A
Pesticides in Water, W73-11618	5B
Organochlorine Insecticides in Surface Waters in Germany-1970 and 1971, W73-11628	5C
CHLORINATED HYDROCARBONS	
Environmental Effects on Toxaphene Toxicity to Selected Fishes and Crustaceans, W73-11323	5C
Chlorinated Hydrocarbons in Open-Ocean Atlantic Organisms, W73-11377	5B
CHLORINATION	
Marine Sanitation System Demonstration, W73-11059	5D
Oxidation of Pyrites in Chlorinated Solvents, W73-11068	5D
CHLORINE	
Activated Carbon for Water Treatment, W73-11352	5F
Activated Carbon for Palatable Water: Granular or powdered. W73-11422	5F
Effect of Chlorine on Fluorescent Dyes, W73-11597	5C
CHLOROPHYLL	
Conditions of Preservation of Chlorophyll, Pheophytin, and Humic Substances in Black Sea Sediments (Usloviya sokhrannosti klorofilla, feofitina i guminovykh veshchestv v otlozheniyakh Chernogo morya), W73-11411	2J
Preliminary Report, (RV Thomas G. Thompson Cruise 66), W73-11583	5A
CHLOROPHYLL DERIVATIVES	
A Quantitative, Semiroutine Method for Determining Algal and Sedimentary Chlorophyll Derivatives, W73-11637	5A
CHLOROPHYTA	
Study of the Changes in the Structure of Two Algal Populations: An R-Type Factor Analysis, W73-11129	5A
Effects of Logging on Periphyton in Coastal Streams of Oregon, W73-11582	5C
CHLOROSARCINA	
The Influence of Simazine on the Photosynthetic Pigments of Green Algae, W73-11610	5C
CHRISTINA RIVER (DEL)	
Pollution Effects on Phycovirus and Host Algae Ecology, W73-11635	5C
CHROMATOGRAPHIC ANALYSIS	
Phenylmercuric Acetate: Metabolic Conversion by Microorganisms, W73-11187	5B
CHROMATOGRAPHY	
Arsenic in the Lipid Extracts of Marine Invertebrates, W73-11189	5C
CHROMIUM	
Determination of Total Chromium in Fresh Waters by Atomic Absorption, W73-11295	5A
The Use of Modern Chromium Accumulations to Determine Estuarine Sedimentation Rates, W73-11392	2L
The Occurrence and Seasonal Variation of Trace Metals in the Scallops Pecten maximus (L.) and Chlamys opercularis (L.), W73-11624	5A
CHRYSOPHYTA	
Effects of Logging on Periphyton in Coastal Streams of Oregon, W73-11582	5C
CIRCULATION (BLOOD)	
Sublethal Effects of Bleached Kraft Pulp Mill Effluent on Respiration and Circulation in Sockeye Salmon (Oncorhynchus nerka), W73-11615	5C
CITY PLANNING	
Housing and Planning References, W73-11251	3D
CLAMS	
Durban (Trademark) and Diazinon Residues in Biota Following Treatment of Intertidal Plots on Cape Cod - 1967-69, W73-11627	5C

SUBJECT INDEX

CLAY MINERALS

CLAY MINERALS
Coefficient of Permeability of Highly Plastic Clays,
W73-11199 2G

CLAYS
Influence of Weathering on Effective Values of Shear Strength of Miocene Clay,
W73-11196 2K

Coefficient of Permeability of Highly Plastic Clays,
W73-11199 2G

Adsorption Characteristics of Opaline Clays From the Eocene of Georgia,
W73-11536 2G

Falling-Drop Technique for Silt-Clay Sediment Analysis,
W73-11558 5A

CLAYS (BENTONITE)
Retention and Release of Soil Water as Related to Mineralogy of the Soil Clays,
W73-11256 2G

CLEVELAND (OHIO)
Ultra High Rate Filtration of Activated Sludge Plant Effluent,
W73-11337 5D

CLIMATES
Climate Change and the Influence of Man's Activities on the Global Environment,
W73-11562 2A

CLIMATIC CHANGE
Climate Change and the Influence of Man's Activities on the Global Environment,
W73-11562 2A

CLIMATIC DATA
A Catalog of Hydroclimatological Data for Alaska's Coastal Zone,
W73-11056 2B

CLIMATOLOGY
Large-Scale and Long-Term Fluctuations in some Atmospheric and Oceanic Variables,
W73-11369 2B

The Role of the Oceans and Biosphere in the Carbon Dioxide Cycle,
W73-11373 2K

Climate Change and the Influence of Man's Activities on the Global Environment,
W73-11562 2A

CLOUD SEEDING
The Impact of Weather Modification on U.S. Planning for the Rio Colorado and Rio Grande,
W73-11505 3B

COAGULATION
Water Supply Improvements Feature New Coagulator,
W73-11315 5F

Activated Carbon for Water Treatment,
W73-11352 5F

COAL MINE WASTES
Oxidation of Pyrites in Chlorinated Solvents,
W73-11068 5D

Hydrogeologic Considerations for Sealing Coal Mines,
W73-11675 5G

Leachate Quality from Acidic Mine Spoil Fertilized with Liquid Digested Sewage Sludge,
W73-11680 5G

COALS

Heavy Metals: Fallout Around a Power Plant,
W73-11282 5A

COASTAL ENGINEERING
Ecological Monitoring of Two Beach Nourishment Projects in Broward County, Florida,
W73-11528 2J

COASTS

A Catalog of Hydroclimatological Data for Alaska's Coastal Zone,
W73-11056 2B

Coastal Dynamics along Mustang Island, Texas,
W73-11081 2L

Protection and Control of the Salt Water Shore Area,
W73-11114 6E

Hydraulic Model Measurements of Tidal Currents Around Cape Henlopen, Delaware,
W73-11203 2L

A Few Coastal Pollution Problems in Japan,
W73-11376 5C

The Acceleration of the Hydrogeochemical Cycling of Phosphorus,
W73-11385 5B

COBALT

The Occurrence and Seasonal Variation of Trace Metals in the Scallop *Pecten maximus* (L.) and Chlamys opercularis (L.),
W73-11624 5A

The Accumulation from Water of ZN-65, MN-54, CO-58, and FE-59 by the Mussel, *Mytilus edulis*,
W73-11625 5A

COHESIVE SOILS
Expansion of Cylindrical Probes in Cohesive Soils,
W73-11520 8D

COHO SALMON (JUVENILE)
Effects of Logging on Growth of Juvenile Coho Salmon,
W73-11433 5C

COKE PLANT WASTES
Biological Removal of Carbon and Nitrogen Compounds from Coke Plant Wastes,
W73-11328 5D

COLD REGIONS
Crude Oil Behavior on Arctic Winter Ice,
W73-11539 5B

COLD VAPOR ATOMIC ABSORPTION SPECTROPHOTOMETRY
Mercury in Harbour Porpoises (*Phocoena phocoena*) From the Bay of Fundy Region,
W73-11588 5C

COLIFORM COUNT
The Bacteriology of the Water Supplies of Rangoon: II. Cool Dry and Hot Dry Seasons,
W73-11630 5C

COLIFORMS
Water Quality Models for Total Coliform,
W73-11135 5B

Investigations into the Occurrence of Coliform Organisms from Pristine Streams,
W73-11428 5B

COLLAPSING SOILS

Wetting Requirements to Improve Collapsing Foundation Soils,
W73-11526 8D

COLLOIDS

Zeta Potential Control Improves Coagulation of Colloidal Water,
W73-11449 5F

COLONIZATION

Experiments on the Movement Behavior of Single-Cell Flowing Water Algae, (Experimente Zum Bewegungsverhalten Von Einzelligen Fliesswasseralgen),
W73-11626 5C

COLOR PHOTOGRAPHY

Aerial Surveillance Spill Prevention System,
W73-11326 5B

COLOR REMOVAL

Dyestuff Color Removal by Ionizing Radiation and Chemical Oxidation,
W73-11329 5D

COLORADO

Effects of Chemical Variations in Aquatic Environments: Volume I, Biota and Chemistry of Picance Creek,
W73-11074 5C

COBALT

Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management,
W73-11150 5G

Stream Depletion Factors, Arkansas River Valley, Southeastern Colorado: A Basis for Evaluating Plans for Conjunctive Use of Ground and Surface Water,
W73-11221 4B

COLORADO RIVER BASIN

Colorado River Water Quality Improvement Program,
W73-11264 5G

COLORIMETRY

A Colorimetric Technique Suggested for Chemical Oxygen Demand Determination,
W73-11599 5A

COLUMBIA RIVER

Radionuclides in Transport in the Columbia River from Pasco to Vancouver, Washington,
W73-11549 5B

On Large Diversions from the Northwest-Normal and High-Flow Years,
W73-11685 6A

COLUMNS

A Probabilistic Approach to Maximum Column Strength,
W73-11516 8A

COMBINED SEWER INTERCEPTORS

MSB Computerized Combined Sewer Control System,
W73-11673 5G

COMBINED SEWERS

MSB Computerized Combined Sewer Control System,
W73-11673 5G

COMBINED TREATMENT

The Northern Maine Regional Treatment System,
W73-11079 5D

SUBJECT INDEX

CORROSION

COMPLEXOMETRIC TITRATION		
2,3-Dihydroxynaphthalene as Indicator for the Complexometric Titration of Iron (III) with EDTA,		
W73-11641	5A	
COMPREHENSIVE PLANNING		
The Evolving Role of the Federal Government in the Management of Lake Michigan,		
W73-11247	6E	
Geonatural Resource Planning, Proposed Guidelines for a Detailed Geonatural Resource Inventory and Analysis Required to Undertake a Comprehensive Planning and Development for Albany/Dougherty County, Georgia,		
W73-11672	7A	
COMPUTER MODELS		
Computer Simulation of Eutrophication,		
W73-11051	5C	
MSB Computerized Combined Sewer Control System,		
W73-11673	5G	
COMPUTER PROGRAMS		
Unsupervised Spatial Clustering with Spectral Discrimination,		
W73-11116	7C	
Urbanization's Drainage Consequence,		
W73-11254	4C	
Recent Developments in the Analytical Application of UV Photoelectron Spectroscopy,		
W73-11489	5A	
Computer Program System for Aerotriangulation,		
W73-11518	7C	
COMPUTER SIMULATION		
The Estimation of the Hydrologic Impact of Urbanization: An Example of the Use of Digital Simulation in Hydrology,		
W73-11259	4C	
COMPUTERS		
Least Cost Method for Sewer Design,		
W73-11360	5G	
Acquisition and Reduction of Gas Chromatographic Data Using a Computer,		
W73-11491	5A	
CONCRETE STRUCTURES		
Diamond Bits Core Samples of New York Roads.		
W73-11461	8A	
Wet Well Woes,		
W73-11462	8A	
CONCRETE TESTS		
Internal Cracking in Reinforced Concrete Members,		
W73-11523	8F	
CONFERENCES		
Information on Activities of the Commission on Surface Waters of the International Association of Scientific Hydrology (IASH) (Informatsiya o rabote komissii poverkhnostnykh vod Mezhdunarodnoy assotsiatii nauchnoy hidrologii (MANG)),		
W73-11414	2A	
CONNATE WATER		
Analysis of Sea Water by Difference Chromatography. Summary of Progress 1972,		
W73-11584	5A	
CONNECTICUT		
Water Supply Plan for the Southeastern Connecticut Region, Volume II, Recommended Plan.		
W73-11249	6B	
Water Resources Inventory of Connecticut: Part 6. Upper Housatonic River Basin,		
W73-11555	2A	
CONSERVATION		
Environmental Conservation,		
W73-11170	6G	
CONSOLIDATION		
Influence of Weathering on Effective Values of Shear Strength of Miocene Clay,		
W73-11196	2K	
CONSTRUCTION		
Bituminous Blanket for Dike at Ludington Pumped Storage Project,		
W73-11504	8F	
CONSTRUCTION COSTS		
Least Cost Method for Sewer Design,		
W73-11360	5G	
Construction Difficulty Index for Tunnel Construction,		
W73-11681	8H	
CONSTRUCTION MATERIALS		
Bituminous Blanket for Dike at Ludington Pumped Storage Project,		
W73-11504	8F	
CONTACT ANGLE (WATER)		
Measurement of Contact Angle of Water in Soils and Sand,		
W73-11273	2G	
CONTINENTAL SHELF		
Hydrographic Study of the Shelf and Slope Waters of New York Bight,		
W73-11110	2E	
CONTINENTAL SLOPE		
Hydrographic Study of the Shelf and Slope Waters of New York Bight,		
W73-11110	2E	
CONTINUOUS FLOW TECHNIQUE		
Survival and Gill Condition of Bluegill (<i>Lepomis macrochirus</i>) and Fathead Minnows (<i>Pimephales promelas</i>) Exposed to Sodium Nitrilotriacetate (NTA) for 28 Days,		
W73-11621	5C	
CONTOURS		
An Individual Approach to Independent Computer Survey,		
W73-11512	7C	
CONTROL SYSTEM		
A Control System for Mill Effluent Disposal,		
W73-11312	5G	
CONTROL SYSTEMS		
Low Cost Multichannel Scanning pH-Stat,		
W73-11492	5A	
CONVEYOR SYSTEMS		
Oil/Sorbent Harvesting System for Use on Vessels of Opportunity,		
W73-11445	5G	
COPEPODS		
Partitioning of a Brackish Water Habitat by Copepod Species,		
W73-11130	5A	
PARASITE COPEPODS OF SOME FRESHWATER FISHES FROM NORTH CAROLINA		
Parasite Copepods of Some Freshwater Fishes from North Carolina,		
W73-11143	21	
COPPER		
Oxidation of Copper (II) Selenide by Thiobacillus Ferrooxidans,		
W73-11171	5C	
ARSENIC, CADMIUM, COPPER, MERCURY, AND ZINC IN SOME SPECIES OF NORTH ATLANTIC FINFISH		
Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish,		
W73-11279	5B	
TRACE METAL CONTENT OF HAIR. I. ZINC AND COPPER CONTENT OF HUMAN HAIR IN RELATION TO AGE AND SEX		
Trace Metal Content of Hair. I. Zinc and copper Content of Human Hair in Relation to Age and Sex,		
W73-11308	5A	
HIGHLY RESISTANT COPPER DETERIORATES IN SEVERELY CORROSIVE SOILS		
Highly Resistant Copper Deteriorates in Severely Corrosive Soils,		
W73-11454	8G	
CORROSION OF METALS IN TROPICAL ENVIRONMENTS-COPPER AND WROUGHT COPPER ALLOYS		
Corrosion of Metals in Tropical Environments-Copper and Wrought Copper Alloys,		
W73-11455	8G	
ACUTE AND LONG-TERM ACCUMULATION OF COPPER BY THE BROWN BULLHEAD, <i>Ictalurus nebulosus</i>		
Acute and Long-Term Accumulation of Copper by the Brown Bullhead, <i>Ictalurus nebulosus</i> ,		
W73-11593	5C	
COPPER DETERMINATION IN WATER BY STANDARD ADDITION POTENTIOMETRY		
Copper Determination in Water by Standard Addition Potentiometry,		
W73-11605	5A	
COPPER INDUCED LESIONS IN ESTUARINE TELEOSTS		
Copper Induced Lesions in Estuarine Teleosts,		
W73-11616	5C	
THE OCCURRENCE AND SEASONAL VARIATION OF TRACE METALS IN THE SCALLOPS <i>Pecten maximus</i> (L.) AND <i>Chlamys opercularis</i> (L.)		
The Occurrence and Seasonal Variation of Trace Metals in the Scallops <i>Pecten maximus</i> (L.) and <i>Chlamys opercularis</i> (L.),		
W73-11624	5A	
SELECTIVE DETERMINATION OF COPPER (II) IN AQUEOUS MEDIA BY ENHANCEMENT OF FLASH-PHOTOLYTICALLY INITIATED RIBOFLAVIN CHEMILUMINESCENCE		
Selective Determination of Copper (II) In Aqueous Media by Enhancement of Flash-Photolytically Initiated Riboflavin Chemiluminescence,		
W73-11636	5A	
COPPER ALLOYS		
Corrosion of Metals in Tropical Environments-Copper and Wrought Copper Alloys,		
W73-11455	8G	
COPPER SULFATE		
Helicopter Application of Copper Sulfate,		
W73-11419	5F	
TWO-POINT COPPER SULFATING PROGRAM LICKS/ALGAE PROBLEM		
Two-Point Copper Sulfating Program Licks/Algae Problem,		
W73-11447	5F	
CORAL		
Carbon Dioxide Dynamics: A Record of Organic Carbon Production, Respiration, and Calcification in the Eniwetok Reef Flat Community,		
W73-11488	5A	
CORE DRILLING		
Diamond Bits Core Samples of New York Roads.		
W73-11461	8A	
CORES		
Multi-Element Neutron Activation Analysis of Sediment Using a Californium-252 Source,		
W73-11644	5A	
CORROSION		
Corrosion of Metals in Tropical Environments-Copper and Wrought Copper Alloys,		
W73-11455	8G	

SUBJECT INDEX

CORROSION

External Corrosion of Buried Ferrous Pipelines/1, W73-11467	8G
Determining the Strength of Corroded Pipe, W73-11527	8G
CORROSION CONTROL	
Highly Resistant Copper Deteriorates in Severely Corrosive Soils, W73-11454	8G
Wet Well Woes, W73-11462	8A
Four Phenomena Affecting Cathodic Protection and Corrosion Rates, W73-11475	8G
A Literature Survey—Performance of Exceptional Metals in Corrosive Environments, W73-11479	8G
Design and Installation of Deep Anode Groundbeds, W73-11480	8B
CORVALLIS-ALBANY AREA (OREG)	
Groundwater Data in the Corvallis-Albany Area, Central Willamette Valley, Oregon, W73-11093	4B
COST ALLOCATION	
Linear Programming use for Evaluating Water Resources and Cost and Benefit Allocation, W73-11683	6A
COST ANALYSIS	
An Economic Analysis of Flood Damage Reduction Alternatives in the Minnesota River Basin, W73-11055	6F
Evaluation of Pollution Abatement Procedures Moraine State Park, W73-11062	5G
Community Improvements and Service Costs, W73-11255	3D
Economic Feasibility of Minimum Industrial Waste Load Discharge Requirements, W73-11335	5D
How to Cut Drilling Costs by Reducing Non-drilling Time, W73-11460	8A
Estimating Well Costs, W73-11476	8A
Cathodic Protection—The Answer to Corrosion Prevention of Underground Structures, W73-11477	8G
Construction Difficulty Index for Tunnel Construction, W73-11681	8H
COST COMPARISONS	
Estimating Well Costs. W73-11476	8A
COST-EFFECTIVENESS	
Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management, W73-11150	5G
COST MINIMIZATION	
Progressive Taxation as a Policy for Water Quality Management, W73-11147	5G

COSTS	
Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management, W73-11150	5G
COTTON	
Removal of Mercury from Aqueous Solutions by Nitrogen-Containing Chemically Modified Cotton, W73-11174	5D
Influence of Soil Temperature and Moisture on Survival and Growth of Strands of <i>Phytophthora omnivorum</i> , W73-11248	3F
COTTON-D	
Short-Term Effects of Irrigation with High Sodium Waters, W73-11111	3C
Radial Propagation of Water Potential in Stems, W73-11181	3F
COWS (DAIRY)	
Metabolism of Tritiated Water in the Dairy Cow, W73-11186	5B
CRABS	
DDT, DDE, and Polychlorinated Biphenyls in Biota From the Gulf of Mexico and Caribbean Sea—1971, W73-11580	5B
Dursban (Trademark) and Diazinon Residues in Biota Following Treatment of Intertidal Plots on Cape Cod - 1967-69, W73-11627	5C
CRACKING	
Internal Cracking in Reinforced Concrete Members, W73-11523	8F
CRACKS	
Internal Cracking in Reinforced Concrete Members, W73-11523	8F
Design, Structural Details, and Discontinuities in Steel, W73-11524	8G
CRAYFISH	
A New Crayfish of the Subgenus <i>Jugicambarus</i> from Tennessee with an Emended Definition of the Subgenus (Astacidae, Decapoda), W73-11590	5A
CROP PRODUCTION	
Freeze-Free (32 F) Seasons of the Major Basins and Plateaus of Nevada, W73-11218	7C
CROP RESPONSE	
Crop Response to Trickle and Subsurface Irrigation, W73-11513	3F
CROPS	
Water Requirements for Optimum Crop Yield, W73-11507	3F
CROSS-SECTIONS	
Problem of the Influence of Shape of Channel Cross Section on Velocity Distribution in a Uniform Turbulent Flow (K voprosu o vliyanii formy secheniya rulsa na raspredeleniye	5D
CUPRIC ION ELECTRODE	
Copper Determination in Water by Standard Addition Potentiometry, W73-11605	5A
CURRENT DENSITY (ELECTRICAL)	
Four Phenomena Affecting Cathodic Protection and Corrosion Rates, W73-11475	8G
CYANIDE	
Process for the Removal of Cyanide from Sewage by Means of Formaldehyde, W73-11224	5D

SUBJECT INDEX

DESALINATION

CYANOPHYTA	Supplementation of Missing Values in Water Quality Data, W73-11687	5G	DEFECTS	Design, Structural Details, and Discontinuities in Steel, W73-11524	8G
Effects of Logging on Periphyton in Coastal Streams of Oregon, W73-11582		5C			
Pollution Effects on Phycovirus and Host Algae Ecology, W73-11635	Unsupervised Spatial Clustering with Spectral Discrimination, W73-11116	7C	DEFICIENT ELEMENTS	Oxygen Deficient Conditions and Nitrate Reduction in the Eastern Tropical North Pacific Ocean, W73-11589	5A
	Recent Developments in the Analytical Application of UV Photoelectron Spectroscopy, W73-11489	5A			
CYLING NUTRIENTS	Physical-Chemical Oceanographic Data from the North Pacific Ocean and Bering Sea, 1971, W73-11595	5A	DEGRADATION (DECOMPOSITION)	Pesticide Degradation by Marine Algae, W73-11601	5B
The Seasonal Cycle of Vitamin B12 in the Strait of Georgia, British Columbia, W73-11578		2L			
Oxygen Deficient Conditions and Nitrate Reduction in the Eastern Tropical North Pacific Ocean, W73-11589	DATA REDUCTION	5A	DEGRADATION (SLOPE)	An Evaluation of the Utility of Available Remote Sensor Returns for a Study of Slope Failure Phenomena, W73-11216	7B
	Acquisition and Reduction of Gas Chromatographic Data Using a Computer, W73-11491	5A			
The Role of Nitrogen in the Aquatic Environment, W73-11640	DDE	5C	DELAWARE	Hydraulic Model Measurements of Tidal Currents Around Cape Henlopen, Delaware, W73-11203	2L
	DDT, DDE, and Polychlorinated Biphenyls in Biota From the Gulf of Mexico and Caribbean Sea-1971, W73-11580	5B			
DADE COUNTY (FLA)	DDT	5B	POLLUTION	Pollution Effects on Phycovirus and Host Algae Ecology, W73-11635	5C
Industrial Waste Survey, Dade County, Florida, W73-11217	Chlorinated Hydrocarbons in Open-Ocean Atlantic Organisms, W73-11377	5B			
	Adsorption of Chlorinated Hydrocarbons from Seawater by a Crosslinked Polymer, W73-11443	5A	DEMINERALIZATION	The Role of Desalting in Providing High Quality Water for Industrial Use, W73-11164	3A
DAIRY WATER	Mercury, DDT, and PCB in Harbour Seals (<i>Phoca vitulina</i>) From the Bay of Fundy and Gulf of Maine, W73-11577	5C			
Studies on the Sources of Pollution in Dairy Water: I. Properties of the Waste Water From Potato Starch Factories (In Japanese), W73-11284	DDT, DDE, and Polychlorinated Biphenyls in Biota From the Gulf of Mexico and Caribbean Sea-1971, W73-11580	5B	APPARATUS	Apparatus for Use in an Improved Electro-Dialysis Process, W73-11230	3A
		5B			
DAM FAILURE	DECANE	5B	DENITRIFICATION	Oxygen Deficient Conditions and Nitrate Reduction in the Eastern Tropical North Pacific Ocean, W73-11589	5A
Ground Rupture in the Baldwin Hills, W73-11206	Biological Oxidation of the Hydrocarbons in Aqueous Phase, W73-11132	5B			
		5B	DENSITY STRATIFICATION	Simultaneous, Multiple-Level Release from Stratified Reservoirs, W73-11567	8B
Drainings of Ice-Dammed Summit Lake, British Columbia, W73-11547	DECISION MAKING	2E			
	Toward a Philosophy of Planning: Attitudes of Federal Water Planners, W73-11073	6A	DENTRIFICATION	Preliminary Report, (RV Thomas G. Thompson Cruise 66), W73-11583	5A
On Large Diversions from the Northwest-Normal and High-Flow Years, W73-11685	Analysis of Engineering Alternatives for Environmental Protection from Thermal Discharges, W73-11078	6A			
	Multilevel Control of Multipollutant System, W73-11363	5G	DEPOSITION (SEDIMENTS)	Hydraulic Model Measurements of Tidal Currents Around Cape Henlopen, Delaware, W73-11203	2L
DANUBE RIVER	DECOMPOSING ORGANIC MATTER	6A			
Characteristics of Ice-Jam Formation on the Soviet Reach of The Danube (Osobennost za-toroobrazovaniya na sovetskoy uchastke Dunayya), W73-11694	Leaf Processing in a Woodland Trout Stream, W73-11112	6B	DEPTH	Physical-Chemical Oceanographic Data from the North Pacific Ocean and Bering Sea, 1971, W73-11595	5A
		5B			
DATA ACQUISITION	DEEP ANODE GROUNDBEDS	5B	DESALINATION	The Mechanism of Formation of 'Skinned' Type Membranes and Their Characterization, W73-11153	3A
Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management, W73-11150	Design and Installation of Deep Anode Groundbeds, W73-11480	8B			
		5B	RESEARCH	Research on Piezodialysis, Third Report, W73-11154	3A
DATA COLLECTIONS	DEEP WELLS	8B			
An Inventory of Suspended Sediment Stations and Type of Data Analysis for Pennsylvania Streams, 1947-70, W73-11083	Abnormal Pressures in Deep Wells of Southwestern Louisiana, W73-11464	8E	THE GROWTH RATE OF ICE CRYSTALS	The Growth Rate of Ice Crystals: The Properties of Carbon Dioxide Hydrate A Review of Properties of 51 Gas Hydrates, W73-11156	3A
		7B			
Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management, W73-11150			INVESTIGATION	Investigation of Polybenzimidazole Hollow Fiber Reverse Osmosis Desalination Membranes, W73-11157	3A
Operation of the Analytical Methodology Information Center, W73-11336					
Comprehensive Regional Water and Sewer Inventory and Analysis, W73-11670					

SUBJECT INDEX

DESALINATION

Spray Freezing, Decanting, Melting and Hydrolysis as Related to Secondary Refrigerant Desalting, W73-11158	3A
Ion Transport Through Layered Ion Exchange Membranes, W73-11160	3A
Investigation of Phase and State Relations in Complex Lipid Systems, W73-11161	3A
A Study of Vapor Phase Polymerization and Crosslinking to Prepare Reverse Osmosis Membranes, W73-11162	3A
Membrane Fouling in Electrodialysis: A Model and Experiments, W73-11163	3A
The Role of Desalting in Providing High Quality Water for Industrial Use, W73-11164	3A
A Neutron Spectroscopic Study of the Diffusive Kinetics and Interactions of Water in Dense Layer Desalination Membranes, W73-11165	3A
Dispersion and Miscible Displacement, W73-11167	3A
Apparatus for Use in an Improved Electro-Dialysis Process, W73-11230	3A
Softening of Sea Water by Addition of Barium Carbonate and Mineral Acid, W73-11237	5F
Emerging Water Supply Technology. W73-11246	3D
Reverse Osmosis Water Purifying System with Gradient Barrier Water Storage Container, W73-11356	3A
Flash Evaporator Structure, W73-11358	3A
DESALINATION PLANTS	
Nuclear Dual Purpose Plants in Regional Development, W73-11496	3A
DESIGN	
Stochastic Reservoir Management and System Design for Irrigation, W73-11152	3F
H ₂ S Removal from Water Without Air Pollution, W73-11314	5F
Least Cost Method for Sewer Design, W73-11360	5G
Discrete Gradient Optimization of Water Systems, W73-11365	8B
Filter Washing Goes Modern, W73-11448	5F
Design Factors for Effective Settling of Coagulated Water, W73-11451	5F
New Bits Can Drill More Hole, W73-11457	8B

An Improved Ekman-Type Grab, W73-11659	5A
DESIGN CRITERIA	
Development and Preliminary Design of a Sorbent-Oil Recovery System, W73-11071	5G
Curtailing Pollution from Metal Finishing, W73-11283	5D
Cathodic Protection—Theory and Practice in the Water Industry, W73-11472	8A
Cathodic Protection—The Answer to Corrosion Prevention of Underground Structures, W73-11477	8G
Design and Installation of Deep Anode Groundbeds, W73-11480	8B
Ice Forces on Vertical Piles, W73-11538	8B
DETECTION LIMIT	
Atomic Absorption Spectrophotometry in the Field of Marine Research, W73-11298	5A
DETECTION LIMITS	
New Picogram Detection System Based on a Mass Spectrometer With an External Ionization Source at Atmospheric Pressure, W73-11608	5A
DETERGENTS	
Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material, W73-11339	5A
Phosphorus in Waste Water, W73-11592	5D
DETERIORATION	
Wet Well Woes, W73-11462	8A
DIALYSIS	
Research on Piezodialysis, Third Report, W73-11154	3A
DIAMOND DRILLING	
Diamond Bits Core Samples of New York Roads. W73-11461	8A
DIAMOND LAKE (ORE)	
Phosphorus Release from Lake Sediments, W73-11072	5C
DIANTHUS-CARYOPHYLLUS-D	
Water Potentials in Nonwilted Dianthus Grown in Different Nutrient Solution Concentrations, W73-11191	2I
DIATOMS	
Study of the Changes in the Structure of Two Algal Populations: An R-Type Factor Analysis, W73-11129	5A
Experiments on the Movement Behavior of Single-Cell Flowing Water Algae, (Experimente Zum Bewegungsverhalten Von Einzelligen Fliesswasseralgen), W73-11626	5C
Spring Phytoplankton Abundance and Productivity in Grand Traverse Bay, Lake Michigan, 1970, W73-11629	5B
DIKES	
Control of Hazardous Chemical Spills by Physical Barriers, W73-11338	5G
Bituminous Blanket for Dike at Ludington Pumped Storage Project, W73-11504	8F
DILUTION ANALYSIS	
Application of Radiochemical Methods in Environmental Research, (Anwendung Radiochemischer Methoden in der Umweltforschung), W73-11125	5A
DILUTION TECHNIQUE	
BOD: Determining the Necessary Dilution Technique, W73-11661	5A

SUBJECT INDEX

DRILLING EQUIPMENT

DINADE SENSING SYSTEM	
Application of Remote Sensing Techniques to Measurement of Use of Outdoor Recreation Resources,	Oxygen Deficient Conditions and Nitrate Reduction in the Eastern Tropical North Pacific Ocean,
W73-11546	W73-11589
	5A
7B	
DIPTERA	
Seasonal Emergence of Some High Arctic Chironomidae (Diptera),	A Comparison of Benthic Microalgal Production Measured by C-14 and Oxygen Methods,
W73-11148	W73-11658
2I	5A
BIOLOGICAL EFFECTS OF FLUCTUATING WATER LEVELS IN THE SNAKE RIVER, GRAND TETON NATIONAL PARK, WYOMING,	Polarographic Method for Nitrate and Dissolved Oxygen Analyses,
W73-11594	W73-11662
2E	5A
DIRECT CURRENTS	Supplementation of Missing Values in Water Quality Data,
Solution of Problems on Interconnected AC Systems by Means of HVDC Transmission Systems,	W73-11687
W73-11521	5G
8C	
DISAGGREGATION PROCESSES	DISTILLATION
Disaggregation Processes in Stochastic Hydrology,	Tube Identifier,
W73-11141	W73-11155
2E	3A
DISCHARGE (WATER)	Centrifugal Distillation System,
Experiment in the Use of Digital Computers to Determine Traveltine on a Tributary Reach of A River (Opyt ispol'zovaniya ETsVM pri opredelenii vremeni dobeganiya na pritochnom uchastke reki),	W73-11223
W73-11692	3A
2E	
DISCONTINUITIES	Softening of Sea Water By Addition of Barium Carbonate and CO ₂ ,
Design, Structural Details, and Discontinuities in Steel,	W73-11236
W73-11524	5F
8G	
DISEASE VECTORS	Nuclear Dual Purpose Plants in Regional Development,
Environmental Hazards in the Control of Disease Vectors,	W73-11496
W73-11182	3A
5C	
DISPERSANT TESTS	Simulated Distillation of Narrow, High Boiling Hydrocarbon Fractions,
Standard Dispersion Effectiveness and Toxicity Tests,	W73-11613
W73-11442	5A
5A	
DISPERSION	DISTRIBUTION
Dispersion and Miscible Displacement,	Environmental Contamination by Lead from a Mine and Smelter,
W73-11167	W73-11267
3A	5C
DISPERSAT TOXICITY TESTS	Distribution of Dissolved Mercury in the Irish Sea,
Standard Dispersion Effectiveness and Toxicity Tests,	W73-11293
W73-11442	5B
5A	
DISSOLVED OXYGEN	Dispersed and Particulate Petroleum Residues in the Gulf of St. Lawrence,
Computer Simulation of Eutrophication,	W73-11612
W73-11051	5B
5C	
ENVIRONMENTAL EFFECTS ON TOXAPHENE TOXICITY TO SELECTED FISHES AND CRUSTACEANS	DISTRIBUTION PATTERNS
Environmental Effects on Toxaphene Toxicity to Selected Fishes and Crustaceans,	Diurnal Variation of Aerosol Trace Element Concentrations in Livermore, California,
W73-11323	W73-11277
5C	5B
DEVELOPMENT OF DISSOLVED OXYGEN CRITERIA FOR FRESHWATER FISH	The Seasonal Cycle of Vitamin B12 in the Strait of Georgia, British Columbia,
Development of Dissolved Oxygen Criteria for Freshwater Fish,	W73-11578
W73-11327	2L
5C	
COMBINED EFFECT OF THERMAL AND ORGANIC POLLUTION ON OXYGEN SAG CURVE	DISTRIBUTION SYSTEMS
Combined Effect of Thermal and Organic Pollution on Oxygen Sag Curve,	Discrete Gradient Optimization of Water Systems,
W73-11423	W73-11365
5C	8B
ORGANIC LOADING OF PETENWEIL RESERVOIR, WISCONSIN	DITCHING
Organic Loading of Petenwell Reservoir, Wisconsin,	The Effects of Ditching on the Mosquito Populations in Some Sections of Juncus Salt Marsh in Carteret County, North Carolina,
W73-11486	W73-11431
5C	4A
EFFECTS OF LOGGING ON PERIPHYTON IN COASTAL STREAMS OF OREGON	DIVERSION LOSSES
Effects of Logging on Periphyton in Coastal Streams of Oregon,	On Large Diversions from the Northwest-Normal and High-Flow Years,
W73-11582	W73-11685
5C	6A
DNEIPER RIVER	DNEIPER RIVER
Use of Digital Computers to Compute Propagation of Flood Waves Along the Cascade of Reservoirs on the Dnieper River (Primemeniye ETsVM dlya rascheta rasprostraneniya voln polodvija po kaskadu gidrouzlov na Dnepre),	W73-11693
	2E
DRILLING EQUIPMENT	DRILLING EQUIPMENT
New Bits Can Drill More Hole,	New Bits Can Drill More Hole,
W73-11457	W73-11457
	8B
DRILL BITS	DRILLING EQUIPMENT
New Bits Can Drill More Hole,	New Down-Hole Tools Improve Drilling,
W73-11457	W73-11458
	8B
DRILLING EQUIPMENT	Rotary Rig Due for Face-Lifting,
New Bits Can Drill More Hole,	W73-11459
W73-11457	8B
DRILLING EQUIPMENT	How to Cut Drilling Costs by Reducing Non-drilling Time,
New Down-Hole Tools Improve Drilling,	W73-11460
W73-11458	8A

SUBJECT INDEX

DRILLING EQUIPMENT

Diamond Bits Core Samples of New York Roads.	
W73-11461	8A
Operation and Capability of the Becker Hammer Drill,	
W73-11470	8C
DROPS (FLUIDS)	
A Model for Rain Erosion of Homogeneous Materials,	
W73-11560	8G
DROPWISE CONDENSATION	
Tube Identifier,	
W73-11155	3A
DRUGS	
Trace Analysis by Enzyme Inhibition and Activation,	
W73-11604	5A
DRY BEDS	
Population Studies of three Aquatic Gastropods in an Intermittent Backwater,	
W73-11494	5A
DUPLIN RIVER ESTUARY (GEO.)	
Volume Transport, Salinity Distribution and Net Circulation in the Duplin Estuary, Georgia,	
W73-11425	2L
DURABILITY	
A Model for Rain Erosion of Homogeneous Materials,	
W73-11560	8G
DURSBAN	
Dursban (Trademark) and Diazinon Residues in Biota Following Treatment of Intertidal Plots on Cape Cod - 1967-69,	
W73-11627	5C
DUSTS	
Volcanic Exhalations and Metal Enrichments at Matupi Harbor, New Britain, T.P.N.G.,	
W73-11292	5B
Geological, Geochemical and Environmental Implications of the Marine Dust Veil,	
W73-11383	5B
DUWAMISH RIVER ESTUARY (WASH.)	
Measurement of Salt-Wedge Excursion Distance in the Duwamish River Estuary, Seattle, Washington, by Means of the Dissolved-Oxygen Gradient,	
W73-11564	5B
DYE INDUSTRY WASTES	
Dyestuff Color Removal by Ionizing Radiation and Chemical Oxidation,	
W73-11329	5D
DYES	
A Study of the Photodegradation of Commercial Dyes,	
W73-11325	5B
DYNAMIC PROGRAMMING	
Stochastic Reservoir Management and System Design for Irrigation,	
W73-11152	3F
Least Cost Method for Sewer Design,	
W73-11360	5G
E. COLI	
Enumeration and Differentiation of Water Bacteria with Phosphorus-32,	
W73-11133	5A

Volatilization of Mercuric Chloride by Mercury-Resistant Plasmid-Bearing Strains of <i>Escherichia coli</i> , <i>Staphylococcus aureus</i> , and <i>Pseudomonas aeruginosa</i> ,	
W73-11286	5B
THE BACTERIOLOGY OF THE WATER SUPPLIES OF RANGOON: II. COOL DRY AND HOT DRY SEASONS,	
W73-11630	5C
EARTH RESOURCES	
Unsupervised Spatial Clustering with Spectral Discrimination,	
W73-11116	7C
EARTH SCIENCES THESAURUS	
Environmental Terminology Index,	
W73-11387	10C
EARTHQUAKES	
The Use of Ocean Tide Records to Detect Motions Premonitory to a Tectonic Event in the Long Beach, California Area,	
W73-11214	7B
Seismic Seiches in Bays, Channels, and Estuaries,	
W73-11532	2H
ECOLOGIC-ECONOMIC ANALYSIS	
Ecologic-Economic Analysis for Regional Development. Some Initial Explorations with Particular Reference to Recreational Resource Use and Environmental Planning,	
W73-11176	6B
ECOLOGICAL DISTRIBUTIONS	
Pollution Effects on Phycovirus and Host Algae Ecology,	
W73-11635	5C
ECOLOGY	
Ecological Monitoring of Two Beach Nourishment Projects in Broward County, Florida,	
W73-11528	2J
Macrobenthic Ecology of a Sawdust-Bearing Substrate in the Penobscot River Estuary (Maine),	
W73-11602	5C
ECONOMIC EFFICIENCY	
Programming Model for Evaluating Economic and Financial Feasibility of Irrigation Projects with Extended Development Periods,	
W73-11149	3F
ECONOMICS	
Economic Feasibility of Minimum Industrial Waste Load Discharge Requirements,	
W73-11335	5D
Optimum Hole Diameter for Water Wells,	
W73-11468	8A
On Large Diversions from the Northwest-Normal and High-Flow Years,	
W73-11685	6A
ECOSYSTEMS	
Factors Controlling Marine Ecosystems,	
W73-11380	5C
Chemical Cycles with Energy Circuit Models,	
W73-11381	2A
The Freshwater Stream, A Complex Ecosystem,	
W73-11389	6G

ECOTYPES	
The Freshwater Stream, A Complex Ecosystem,	
W73-11389	6G
EDTA	
2,3-Dihydroxynaphthalene as Indicator for the Complexometric Titration of Iron (III) with EDTA,	
W73-11641	5A
EEL RIVER (CALIF.)	
Sand Transport by the Eel River and Its Effect on Nearby Beaches,	
W73-11559	2L
EFFICIENCIES	
How to Cut Drilling Costs by Reducing Non-drilling Time,	
W73-11460	8A
EFFLUENTS	
Multilevel Control of Multipollutant System,	
W73-11363	5G
Identification of the Constituents of Kraft Pulp Effluent That are Toxic to Juvenile Coho Salmon (<i>Oncorhynchus kisutch</i>),	
W73-11638	5A
EKMAN GRAB SAMPLER	
An Improved Ekman-Type Grab,	
W73-11659	5A
ELECTRIC POWER	
Peak Load Pricing Model of an Electric Utility Using Pumped Storage,	
W73-11146	6A
Apollo Experience Report, Potable Water System,	
W73-11202	5F
ELECTRICAL WELL LOGGING	
Typical Log-Curve Shapes Indicate Formation Characteristics,	
W73-11456	8A
ELECTRO-OSMOSIS	
Four Phenomena Affecting Cathodic Protection and Corrosion Rates,	
W73-11475	8G
ELECTRODIALYSIS	
Ion Transport Through Layered Ion Exchange Membranes,	
W73-11160	3A
Membrane Fouling in Electrodialysis: A Model and Experiments,	
W73-11163	3A
Apparatus for Use in an Improved Electro-Dialysis Process,	
W73-11230	3A
ELECTROLYSIS	
Apparatus for Treating Sewage,	
W73-11231	5D
ELECTROLYTES	
Zeta Potential Control Improves Coagulation of Colloidal Water,	
W73-11449	5F
Improved Water at Lower Cost Produced with Coagulant Aid,	
W73-11666	5F
ELECTROLYTIC CORROSION	
External Corrosion of Buried Ferrous Pipelines/1,	
W73-11467	8G

SUBJECT INDEX

EROSION RATIO

ELECTROMAGNETIC WAVES	
Direct Determination of the Electromagnetic Reflection Properties of Smooth Brackish Water to the Continuous Spectrum from 100 million to 4 billion Hertz, W73-11052	2L
ELECTRON MICROPROBE ANALYSIS	
Precision and Detection Limits of Cadmium, Manganese, Cobalt, and Nickel in Sulfides by Electron Microprobe Analysis, W73-11178	5A
ELECTRON TRANSPORT	
Continuous Culture of Rhodotorula rubra: Kinetics of Phosphate-Arsenate Uptake, Inhibition, and Phosphate-Limited Growth, W73-11574	5A
Preliminary Report, (RV Thomas G. Thompson Cruise 66), W73-11583	5A
ELODEA OCCIDENTALIS	
Plant Analysis for Nutrient Assay of Natural Waters, W73-11057	5C
ELUTION	
A Simple Microscale Vacuum Collector for the Elution of Closely Situated Spots from Thin-Layer Chromatograms, W73-11657	5A
EMERGENCY SERVICE	
A Rapidly Deployable Oil Containment Boom for Emergency Harbor Use, W73-11439	5G
EMISSIONS	
Auto Exhaust - Lead Vs Aromatics, W73-11301	5A
EMULSIONS	
Removal of Oil From Under Piers, W73-11438	5G
ENERGY CIRCUIT MODELS	
Chemical Cycles with Energy Circuit Models, W73-11381	2A
ENERGY CONVERSION	
Energy vs. Environment, W73-11500	6G
ENGLAND	
Infant Mortality and Hardness of Local Water Supplies, W73-11144	5C
ENGLAND (CHESHIRE)	
Plant Communities of Wet Ground in Northeast Cheshire, England, W73-11552	2L
ENRICHMENT EXPERIMENTS	
An In Situ Evaluation of Nutrient Effects in Lakes, W73-11070	5C
ENTEROBACTER	
The Bacteriology of the Water Supplies of Rangoon: II. Cool Dry and Hot Dry Seasons, W73-11630	5C
ENTHALPY	
Salt and Nonelectrolyte Interactions in Water, W73-11166	1B
ENTRAINMENT	
A Small Vacuum Oil Skimming System, W73-11436	5G
ENTROPY	
Salt and Nonelectrolyte Interactions in Water, W73-11166	1B
ENVIRONMENT	
An Environmental Evaluation System for Water Resource Planning, W73-11151	6A
Environmental Terminology Index, W73-11387	10C
Climate Change and the Influence of Man's Activities on the Global Environment, W73-11562	2A
ENVIRONMENTAL CONTROL	
Analysis of Engineering Alternatives for Environmental Protection from Thermal Discharges, W73-11078	5G
ENVIRONMENTAL EFFECTS	
Mineral Industry Vs. Ecology, W73-11185	5G
Qualitative Values in Environmental Planning: A Study of Resource Use in Urbanizing Watersheds, W73-11253	5G
Prague International Lead Panel: Effects of Atmospheric Lead on Biological Systems, W73-11265	5C
Some Thermal Consequences of Environmental Manipulations of Water, W73-11355	5C
Energy vs. Environment, W73-11500	6G
Economic Growth and Environmental Impact: Evaluating Alternatives, W73-11511	6B
Wastewater Management Through Land Utilization - Muskegan County, Michigan, USA, W73-11515	5D
ENVIRONMENTAL ENGINEERING	
Least Cost Method for Sewer Design, W73-11360	5G
Nonlinear Parameter Estimation in Water Quality Modeling, W73-11361	5B
Generic Feed Forward Control of Activated Sludge, W73-11362	5D
Multilevel Control of Multipollutant System, W73-11363	5G
ENVIRONMENTAL HAZARDS	
Environmental Hazards in the Control of Disease Vectors, W73-11182	5C
ENVIRONMENTAL IMPACT ANALYSIS	
An Environmental Evaluation System for Water Resource Planning, W73-11151	6A
ENVIRONMENTAL QUALITY	
An Environmental Evaluation System for Water Resource Planning, W73-11151	6A
Energy vs. Environment, W73-11500	6G
Wastewater Management Through Land Utilization - Muskegan County, Michigan, USA, W73-11515	5D
ENVIRONMENTAL SAMPLES	
Improved Method for Characterizing Environmental Hydrocarbons by Gas Chromatography, W73-11607	5A
ENVIRONMENTAL SANITATION	
Marine Sanitation System Demonstration, W73-11059	5D
Environmental Health Planning, W73-11244	5G
ENVIRONMENTAL STUDIES	
Environmental Conservation, W73-11170	6G
ENZYMES	
Fluorescent Probes in the Detection of Insecticides in Water, W73-11061	5A
ENZYME KINETICS	
The Relationship of Enzyme Kinetic Heterotrophy Analysis to Other Eutrophication Indices, W73-11432	5C
ENZYMES	
Trace Analysis by Enzyme Inhibition and Activation, W73-11604	5A
Influence of Lead and Other Metals on Fish Delta-Aminolevulinate Dehydrase Activity, W73-11646	5A
Sublethal Effects of Baltimore Harbor Water on the White Perch, Morone americana, and the Hogchoker, Trinectes maculatus, W73-11652	5C
EQUATIONS	
Steady-State Seepage in a Hillside, W73-11212	2G
EQUILIBRIUM	
The Chemical Stability of the Oceans and the CO ₂ System, W73-11374	2K
EQUILIBRIUM WELFARE ECONOMICS	
Peak Load Pricing Model of an Electric Utility Using Pumped Storage, W73-11146	6A
EQUIPMENT	
Sampling Procedures and Problems in Determining Pesticide Residues in the Hydrologic Environment, W73-11660	5A
EROSION	
Physical Erosion and Denudation Rates in Cartwright Basin and Vicinity, Williamson County, Tennessee, W73-11140	2J
EROSION CONTROL	
Protection and Control of the Salt Water Shore Area, W73-11114	6E
EROSION RATIO	
Investigation on Erodibility and Water Stable Aggregates of Certain Soils of Eastern Nepal, W73-11272	2J

SUBJECT INDEX

ESCAMBIA COUNTY (ALA)

ESCAMBIA COUNTY (ALA)
Mobile Area Water Transportation Study of Mobile, Baldwin and Escambia Counties, Alabama.
W73-11260 8A

Comprehensive Water and Sewer Plan for Escambia County, Alabama.
W73-11262 5D

ESCAMBIA COUNTY (FLA)

Availability of Groundwater for Public-Water Supply in Central and Southern Escambia County, Florida: Interim Report, July 1972, W73-11563 2F

ESTUARIES

A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. V, Jamaica Bay Rainstorms, W73-11351 5B

The Acceleration of the Hydrogeochemical Cycling of Phosphorus, W73-11385 5B

A Study of Coastal Water Quality in the Vicinity of San Juan, Puerto Rico, January 13-31, 1971, W73-11388 5B

The Use of Modern Chromium Accumulations to Determine Estuarine Sedimentation Rates, W73-11392 2L

Volume Transport, Salinity Distribution and Net Circulation in the Duplin Estuary, Georgia, W73-11425 2L

Measurement of Salt-Wedge Excursion Distance in the Duwamish River Estuary, Seattle, Washington, by Means of the Dissolved-Oxygen Gradient, W73-11564 5B

Cycling of Elements of Estuaries, W73-11645 5B

ESTUARINE ENVIRONMENT

Macrofaunal Ecology of a Sawdust-Bearing Substrate in the Penobscot River Estuary (Maine), W73-11602 5C

EUTROPHICATION

Computer Simulation of Eutrophication, W73-11051 5C

Plant Analysis for Nutrient Assay of Natural Waters, W73-11057 5C

An In Situ Evaluation of Nutrient Effects in Lakes, W73-11070 5C

Phosphorus Release from Lake Sediments, W73-11072 5C

Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri, W73-11271 5C

Phosphorus Removal, A Bibliography, Volume I, W73-11319 5D

Phosphorus Removal, A Bibliography, Volume 2, W73-11320 5D

The Relationship of Enzyme Kinetic Heterotrophy Analysis to Other Eutrophication Indices, W73-11432 5C

The Role of Nitrogen in the Aquatic Environment, W73-11640 5C

EVALUATION

Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management, W73-11150 5G

An Environmental Evaluation System for Water Resource Planning, W73-11151 6A

Precision and Detection Limits of Cadmium, Manganese, Cobalt, and Nickel in Sulfides by Electron Microprobe Analysis, W73-11178 5A

City of Albuquerque Sandia Foothills Drainage, W73-11668 4A

Geonatural Resource Planning, Proposed Guidelines for a Detailed Geonatural Resource Inventory and Analysis Required to Undertake a Comprehensive Planning and Development for Albany/Dougherty County, Georgia, W73-11672 7A

Linear Programming use for Evaluating Water Resources and Cost and Benefit Allocation, W73-11683 6A

EVALUATIONS

Supplement to City of Albuquerque Sandia Foothills Drainage Study, W73-11669 4A

EVAPORATION

Comparison of Simulated and Actual Evaporation From Maize and Soil in a Lysimeter, W73-11201 2D

Centrifugal Distillation System, W73-11223 3A

Radiation, Evaporation and the Maintenance of Turbulence under Stable Conditions in the Lower Atmosphere, W73-11343 2D

A Power Wind Law for Turbulent Transfer Computations, W73-11344 2D

Computing Evapotranspiration by Geostrophic Drag Concept, W73-11345 2D

Unified Formulation of Wall Turbulence, W73-11346 2D

Sensitivity of the Solution for Heat Flux or Evaporation to Off-Diagonal Turbulent Diffusivities, W73-11347 2D

Perturbation Solution of an Equation of Atmospheric Turbulent Diffusion, W73-11348 2D

A Solution for Simultaneous Turbulent Heat and Vapor Transfer between a Water Surface and the Atmosphere, W73-11349 2D

EVAPORATORS

Tube Identifier, W73-11155 3A

Flash Evaporator Structure, W73-11358 3A

EVERGLADES NATIONAL PARK

Applications of Multispectral Remote Sensing Techniques to Hydrobiological Investigations in Everglades National Park, W73-11553 7B

EXCRETION

Study of the Respiration and the Nitrogen and Phosphorus Excretion of Zooplanktonic Populations of the Mauritanian Upwelling, (March-April 1972). (Etude de la Respiration et de l'Excretion d'Azote et de Phosphore des populations Zooplanctoniques de l'Upwelling Mauritanien (Mars-Avril 1972), W73-11603 5B

EXTENDED AERATION

Cannery Wastewater Treatment with Rotating Biological Contactor and Extended Aeration, W73-11058 5D

EXTRA HIGH VOLTAGE

Solution of Problems on Interconnected AC Systems, by Means of HVDC Transmission Systems, W73-11521 8C

FABRICATION

All-Position Production Welding with Flux-Cored Gas-Shielded Electrodes, W73-11501 8C

FAILURE (MECHANICS)

Torsional Stiffness of Reinforced Concrete Members Subjected to Pure Torsion, W73-11519 8F

Determining the Strength of Corroded Pipe, W73-11527 8G

FALLOUT

Heavy Metals: Fallout Around a Power Plant, W73-11282 5A

Lead Pollution from a Factory Manufacturing Anti-Knock Compounds, W73-11290 5B

FALLOUT (KRAFT MILL)

Fallout of Sodium Sulphate near a Kraft Mill, W73-11175 5A

FARM WASTES

Possibility of Reducing Nitrogen in Drainage Water By On Farm-Practices, Bio-Engineering Aspects of Agricultural Drainage, San Joaquin Valley, California, W73-11324 5B

FATIGUE (MECHANICS)

Design, Structural Details, and Discontinuities in Steel, W73-11524 8G

FATIGUE TESTS

Flexural Fatigue Strength of Steel Fiber Reinforced Concrete Beams, W73-11498 8F

FATTY ACIDS

Petroleum Hydrocarbons and Fatty Acids in Wastewater Effluents, W73-11575 5B

Identification of the Constituents of Kraft Pulping Effluent That are Toxic to Juvenile Coho Salmon (*Oncorhynchus kisutch*), W73-11638 5A

SUBJECT INDEX

FLASH PHOTOLYSIS

FAULTS (GEOLOGIC)				
Ground Rupture in the Baldwin Hills, W73-11206	5E	Water Supply Improvements Feature New Coagulator, W73-11315	5F	FISH BEHAVIOR
Abnormal Pressures in Deep Wells of Southwestern Louisiana, W73-11464	8E	Ultra High Rate Filtration of Activated Sludge Plant Effluent, W73-11337	5D	Fish and Food Organisms in Acid Mine Waters of Pennsylvania, W73-11332
		Zeta Potential Control Improves Coagulation of Colloidal Water. W73-11449	5F	SC
FEASIBILITY STUDIES		Microstraining Removes Algae and Cuts Filter Back-Washing, W73-11450	5F	FISH CULTURAL ACTIVITIES
Ozone for Supplementary Water Treatment, W73-11677	5F	Design Factors for Effective Settling of Coagulated Water, W73-11451	5F	Pollution as a Result of Fish Cultural Activities, W73-11077
		Improved Water at Lower Cost Produced with Coagulant Aid, W73-11666	5F	5B
FEDERAL GOVERNMENT		60-MGD Microstraining Plant Meets Denver's Growing Needs, W73-11667	5F	FISH DIET
Toward a Philosophy of Planning: Attitudes of Federal Water Planners, W73-11073	6A		The Food of Brown Trout in Llyn Alaw, Anglesey, North Wales, W73-11354	
The Evolving Role of the Federal Government in the Management of Lake Michigan, W73-11247	6E		2I	
Research and Development in Water Resources, Water Resources Research, Its Role in the Total R and D Spectrum, W73-11341	6B	FISH EGGS		
		Programing Model for Evaluating Economic and Financial Feasibility of Irrigation Projects with Extended Development Periods, W73-11149	3F	Low pH Values Shown to Affect Developing Fish Eggs (<i>Brachydanio rerio Ham.-Buch.</i>), W73-11651
FEDERAL PROJECT POLICY		FINANCIAL FEASIBILITY		SC
Toward a Philosophy of Planning: Attitudes of Federal Water Planners, W73-11073	6A	Financing Private Water Resource Development: Analysis of a State Loan Program, W73-11686	3F	FISH HATCHERIES
FEED FORWARD CONTROL				Pollution as a Result of Fish Cultural Activities, W73-11077
Generic Feed Forward Control of Activated Sludge, W73-11362	5D	FINANCING		5B
		Financing Private Water Resource Development: Analysis of a State Loan Program, W73-11686	3F	FISH HATCHERY DISCHARGES
FEEDING RATES				Pollution as a Result of Fish Cultural Activities, W73-11077
Response of Lobsters <i>Homarus americanus</i> to Odor Solution in the Presence of Bleached Kraft Mill Effluent, W73-11619	5C	FINFISH		5B
		Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish, W73-11279	5B	FISH MUSCLES
FERTILIZERS				Sea Fish Contamination With Mercury (Contamination des poissons de mer par le mercure), W73-11289
Fertilizer Response to the Physical Effects of Soil Compaction, W73-11280	3F	FINITE ELEMENT ANALYSIS		SC
Possibility of Reducing Nitrogen in Drainage Water By On Farm-Practices, (Bio-Engineering Aspects of Agricultural Drainage, San Joaquin Valley, California).	5B	Finite Element Solution for General Fluid Motion, W73-11091	8B	FISH PARASITES
W73-11324				Parasites of Fish from Lake of the Woods, Ontario, W73-11172
Influence of Agricultural Practices on Water Quality in Nebraska: A Survey of Streams, Groundwater, and Precipitation, W73-11696	5B	FINNEY COUNTY (KANS)		2I
		Ground Water in Finney County, Southwestern Kansas, W73-11106	7C	FISH PHYSIOLOGY
FILMS				Sublethal Effects of Baltimore Harbor Water on the White Perch, <i>Morone americana</i> , and the Hogchoker, <i>Trinectes maculatus</i> , W73-11652
Tube Identifier, W73-11155	3A	FIRE STREAMS		5C
Photographic Water Conservation and Reclamation Processes Study, W73-11403	5A	Using Fire Streams With a Self-Propelled Oil Spill Skimmer, W73-11434	5G	FLAGFISH
				A Cyprinodontid Fish, <i>Jordanella floridae</i> , as a Laboratory Animal for Rapid Chronic Bioassays, W73-11598
FILTER FABRICS		FISH		SC
Ground Water Recharge Through Pits and Wells, W73-11053	4B	Determination of Mercury Contents in Diverse Samples of Fish and Other Biological Materials by Neutron Activation Analysis, (Neutronenaktivierungsanalytische Bestimmungen von Quecksilbergehalten in Diversen Fischproben und Anderen Biologischen Materialien), W73-11123	5A	FLAME IONIZATION
				Gas Chromatographic and Mass Spectrometric Studies of S-Alkyl Derivatives of N,N-Dialkyl Dithiocarbamates, W73-11622
FILTRATION		FLAME IONIZATION GAS		5A
Ground Water Recharge Through Pits and Wells, W73-11053	4B			CHROMATOGRAPHY
		Impairment of the Flavor of Fish by Water Pollutants, W73-11322	5C	Petroleum Hydrocarbons and Fatty Acids in Wastewater Effluents, W73-11575
Tertiary Filtering Arrangement, W73-11241	5D			5B
		Development of Dissolved Oxygen Criteria for Freshwater Fish, W73-11327	5C	Improved Method for Characterizing Environmental Hydrocarbons by Gas Chromatography, W73-11607
Water-Solids Separation in an Upflow: With Particular Reference to Use of a Slurry Pool for Solids Contact in Water Treatment, W73-11313	5F			5A
		Dursban (Trademark) and Diazinon Residues in Bioti Following Treatment of Intertidal Plots on Cape Cod - 1967-69, W73-11627	5C	FLAMELESS ATOMIC ABSORPTION SPECTROPHOTOMETRY
				Mercury in Public Sewer Systems, W73-11585
				5D
		FLASH DISTILLATION		
		Flash Evaporator Structure, W73-11358	3A	
				FLASH PHOTOLYSIS
		Selective Determination of Copper (II) In Aqueous Media by Enhancement of Flash-		

SUBJECT INDEX

FLASH PHOTOLYSIS

Photolytically Initiated Riboflavin Chemiluminescence,
W73-11636 5A

FLEXURAL STRENGTH

Flexural Fatigue Strength of Steel Fiber Reinforced Concrete Beams,
W73-11498 8F

FLINT RIVER (MICH)

A Study of the Flint River, Michigan, as it Relates to Low-Flow Augmentation,
W73-11207 5G

FLOCCULATION

Accelerated Biological-Chemical Wastewater Treatment,
W73-11229 5D

Apparatus for Treating Sewage,
W73-11231 5D

FLOOD CONTROL

Iterative Simulation Algorithm in Reservoir Systems Operation,
W73-11139 4A

Urbanization's Drainage Consequence,
W73-11254 4C

Supplement to City of Albuquerque Sandia Foothills Drainage Study.
W73-11669 4A

Reduction of Hydraulic Sewer Loadings by Downspout Removal,
W73-11671 4A

Study for Improvement of Monte Sano Bayou from Airline Highway to Mississippi River East Branch Rouge Parish, Louisiana.
W73-11682 8A

FLOOD DAMAGE

Flood of June 9-10, 1972, at Rapid City, South Dakota,
W73-11105 7C

FLOOD DATA

Flood of June 9-10, 1972, at Rapid City, South Dakota,
W73-11105 7C

FLOOD FORECASTING

Precputation of a Spring-Flood Hydrograph Based on Hydrometeorological Data (Predvychisleniye gidrografa vesennego polovod'ya po gidrometeorologicheskim dannym),
W73-11689 2E

FLOOD FREQUENCY

Virginia Small Streams Program, Preliminary Flood-Frequency Relations,
W73-11090 2E

FLOOD PLAIN MANAGEMENT

Urbanization's Drainage Consequence,
W73-11254 4C

FLOOD PLAINS

An Economic Analysis of Flood Damage Reduction Alternatives in the Minnesota River Basin,
W73-11055 6F

FLOOD PROFILES

Flood of June 9-10, 1972, at Rapid City, South Dakota,
W73-11105 7C

FLOOD PROTECTION

An Economic Analysis of Flood Damage Reduction Alternatives in the Minnesota River Basin,
W73-11055 6F

FLOOD ROUTING

Use of Digital Computers to Compute Propagation of Flood Waves Along the Cascade of Reservoirs on the Dnieper River (Primeneniye ETsVM diya rascheta rasprostraneniya voln polovodiy po kaskadu gidrouzlov na Dnepre),
W73-11693 2E

FLOOD WAVES

Use of Digital Computers to Compute Propagation of Flood Waves Along the Cascade of Reservoirs on the Dnieper River (Primeneniye ETsVM diya rascheta rasprostraneniya voln polovodiy po kaskadu gidrouzlov na Dnepre),
W73-11693 2E

FLOODS

Virginia Small Streams Program, Preliminary Flood-Frequency Relations,
W73-11090 2E

Flood of June 9-10, 1972, at Rapid City, South Dakota,
W73-11105 7C

Effects of Urbanization on Floods in the Houston, Texas, Metropolitan Area,
W73-11402 4C

An Investigation of Floods in Hawaii Through September 30, 1972,
W73-11404 2E

FLORIDA

Industrial Waste Survey, Dade County, Florida.
W73-11217 5B

Hydrologic Records for Volusia County, Florida: 1971-72,
W73-11399 7C

Applications of Multispectral Remote Sensing Techniques to Hydrobiological Investigations In Everglades National Park,
W73-11553 7B

Availability of Groundwater for Public-Water Supply in Central and Southern Escambia County, Florida: Interim Report, July 1972,
W73-11563 2F

Electrical-Analog Model Study of a Hydrologic System in Southeast Florida,
W73-11570 2A

FLOW

Finite Element Solution for General Fluid Motion,
W73-11091 8B

Problem of the Influence of Shape of Channel Cross Section on Velocity Distribution in a Uniform Turbulent Flow (K voprosu o vliyaniye formy secheniya rulsa na raspredeleniye skorostey v ravnnomernom turbulentnom potokе),
W73-11408 8B

FLOW MEASUREMENT

A Flow Proportional Composite Sampler,
W73-11463 5A

FLOW PROPORTIONING

A Flow Proportional Composite Sampler,
W73-11463 5A

FLOW RATES

Biological Effects of Fluctuating Water Levels in the Snake River, Grand Teton National Park, Wyoming,
W73-11594 2E

FLUORESCENCE

Fluorescent Probes in the Detection of Insecticides in Water,
W73-11061 5A

Remote Sensing Techniques for Detecting Oil Slicks,
W73-11137 5A

FLUORESCENT ANTIBODY TECHNIQUES

Application of the Fluorescent Antibody Technique to the Differentiation of Aspergillus Species, Candida Species and Zygomycetes in Paraffin Section of Formalin-Fixed Tissues,
W73-11126 5A

FLUORESCENT DYE

Effect of Chlorine on Fluorescent Dyes,
W73-11597 5C

FLUORESCENT PROBES

Fluorescent Probes in the Detection of Insecticides in Water,
W73-11061 5A

FLUORIDES

Purification of Waste Water,
W73-11238 5D

FLUOROMETRY

Effect of Chlorine on Fluorescent Dyes,
W73-11597 5C

FLY ASH

The Heavy Metal Content of Rainfall in the East Midlands,
W73-11648 5A

FOETUS

Transfer of Metallic Mercury into the Foetus,
W73-11274 5B

FOOD CHAINS

Mercury in the Marine Environment: Concentration in Sea Water and in a Pelagic Food Chain,
W73-11300 5C

Factors Controlling Marine Ecosystems,
W73-11380 5C

FOOD CONVERSION EFFICIENCY

Effects of Sublethal Concentrations of Sodium Pentachlorophenate on Growth Rate, Food Conversion Efficiency, and Swimming Performance in Underyearling Sockeye Salmon (*Oncorhynchus nerka*),
W73-11656 5C

FOOD PROCESSING INDUSTRY

Low Water Volume Enzyme Deactivation of Vegetables Before Preservation,
W73-11330 5D

FOODS

Determination of Mercury Contents in Diverse Samples of Fish and Other Biological Materials by Neutron Activation Analysis, (Neutronenaktivierungsanalytische Bestimmungen von Quecksilbergehalten in Diversen Fischproben und Anderen Biologischen Materialien),
W73-11123 5A

Trace Elements in the Human Environment,
W73-11304 5B

SUBJECT INDEX

GEOCHEMISTRY

FORAMINIFERIDS						
Living Foraminiferids of Tidal Marshes: A Review,						
W73-11502	2L					
FORECASTING						
Formation and Forecast of Components in the Hydrologic Regimen of Rivers (Formirovaniye i prognozy elementov gidrologicheskogo rezhima rek).						
W73-11688	2E					
Forecasting Quarterly Inflow of Water to Dnieper River Reservoirs During the Cold Half of the Year (O prognozirovaniii kvartal'nogo protoka vody v dneprovskiy vodokhranilishcha za kholodnyu polovinu goda),						
W73-11691	2H					
Forecasting Time of Formation of Complete Ice Cover of the Upper Dnieper Basin (O prognozirovaniii srokov nastupleniya ledostava v basseyne Verkhnego Dnepra),						
W73-11695	2C					
FOREIGN PROJECTS						
Report of the United States Delegation Visit to the Soviet Union: July 24 to August 6, 1972,						
W73-11508	8C					
FOREIGN RESEARCH						
Hydrology and Water Resources Development in Nepal,						
W73-11401	4A					
FORESTATION EFFECTS						
The Effect of Afforestation on Streamflow at Cathedral Peak: Report No. 1,						
W73-11310	4C					
FORT WORTH AREA (TEX)						
Annual Compilation and Analysis of Hydrologic Data for Urban Studies in the Fort Worth, Texas, Metropolitan Area, 1971,						
W73-11215	4C					
FOULING						
Investigation of Polybenzimidazole Hollow Fiber Reverse Osmosis Desalination Membranes,						
W73-11157	3A					
FOUNDATION INVESTIGATIONS						
Wetting Requirements to Improve Collapsing Foundation Soils,						
W73-11526	8D					
FOUNDATIONS						
Behaviour of Fine Sands and Silts During the Rise of Ground-Water Level,						
W73-11194	2G					
FRACTURE MECHANICS						
Design, Structural Details, and Discontinuities in Steel,						
W73-11524	8G					
Designing to Prevent Brittle Fractures in Bridges,						
W73-11525	8G					
FRAMES						
Simplified Computer Approach to the Ultimate Load Analysis and Design of Reinforced Concrete Frames,						
W73-11499	8F					
FREEZING						
The Growth Rate of Ice Crystals: The Properties of Carbon Dioxide Hydrate A Review of Properties of 51 Gas Hydrates,						
W73-11156	3A					
Spray Freezing, Decanting, Melting and Hydrolysis as Related to Secondary Refrigerant Desalting,						
W73-11158						
High-Temperature Contact Nucleation of Supercooled Water by Organic Chemicals and Appendix of Compounds Tested,						
W73-11699						
FREQUENCY ANALYSIS						
Virginia Small Streams Program, Preliminary Flood-Frequency Relations,						
W73-11090	2E					
FRESCON						
A Study of a Small Tropical Lake Treated With the Molluscicide Frescon,						
W73-11614						
FRESHWATER FISH						
A Study of a Small Tropical Lake Treated With the Molluscicide Frescon,						
W73-11614	5C					
Pesticides in Water,						
W73-11618	5B					
FROST ACTION						
Moisture Transfer and Frost Heave in Loams,						
W73-11193	2G					
FROST HEAVING						
Moisture Transfer and Frost Heave in Loams,						
W73-11193	2G					
FULLER'S EARTH						
Adsorption Characteristics of Opaline Clays From the Eocene of Georgia,						
W73-11536	2G					
FUNDULUS HETEROCRITUS						
Copper Induced Lesions in Estuarine Teleosts,						
W73-11616	5C					
FUNGI						
Metal Toxicity to Sewage Organisms, A Discussion,						
W73-11266	5D					
FUTURE PLANNING						
Scope of Public Water Supply Needs.						
W73-11245	6D					
GALVANIC CORROSION						
Highly Resistant Copper Deteriorates in Severely Corrosive Soils,						
W73-11454	8G					
External Corrosion of Buried Ferrous Pipelines/1,						
W73-11467	8G					
Cathodic Protection--Theory and Practice in the Water Industry,						
W73-11472	8A					
GAME BIRDS						
Incidence of Mercury in Illinois Pheasants,						
W73-11305	5A					
GAMMA RAYS						
Dyestuff Color Removal by Ionizing Radiation and Chemical Oxidation,						
W73-11329	5D					
GARZA-LITTLE ELM RESERVOIR						
Nutrient Ratio Variation in Reservoir Sediments,						
W73-11591	5B					
GAS CHROMATOGRAPHY						
Clean-Up of Crude Extracts Containing Pesticide Residues by an Automatic Apparatus Based Upon the Principle of 'Sweep Co-Distillation, (Reinigung Pestiziddruckstande Enthalender Rohextrakte Mit Einer Automatischen Arbeitenden Apparatur Nach Dem Prinzip der Kombinierten Spülund Codestillation (Sweep Codistillation),						
W73-11124	5A					
BIOLOGICAL OXIDATION OF THE HYDROCARBONS IN AQUEOUS PHASE,						
W73-11132	5B					
ACQUISITION AND REDUCTION OF GAS CHROMATOGRAPHIC DATA USING A COMPUTER,						
W73-11491	5A					
DURBAN (TRADEMARK) AND DIAZINON RESIDUES IN BIOTA FOLLOWING TREATMENT OF INTERTIDAL PLOTS ON CAPE COD - 1967-69,						
W73-11627	5C					
GAS EXCHANGE						
Small-Scale Experiments to Determine the Effects of Crude Oil Films on Gas Exchange Over the Coral Back-Reef at Heron Island,						
W73-11650	5C					
GASOLINE						
Auto Exhaust - Lead Vs Aromatics,						
W73-11301	5A					
GC-INFRARED SPECTROSCOPY						
Gas Chromatograph Peaks Identified On-Line by a New Grating Infrared Spectrophotometer,						
W73-11609	5A					
GC-MASS SPECTROMETRY						
Comparison of Selective Ion Monitoring and Repetitive Scanning During Gas Chromatography-Mass Spectrometry,						
W73-11493	5A					
New Picogram Detection System Based on a Mass Spectrometer With an External Ionization Source at Atmospheric Pressure,						
W73-11608	5A					
Gas Chromatographic and Mass Spectrometric Studies of S-Alkyl Derivatives of N,N-Dialkyl Dithiocarbamates,						
W73-11622	5A					
Improved Double Detection Gas Chromatograph-Mass Spectrometer Interface for the Analysis of Complex Organic Mixtures,						
W73-11663	5A					
GC-PHOTOELECTRON SPECTROSCOPY						
Recent Developments in the Analytical Application of UV Photoelectron Spectroscopy,						
W73-11489	5A					
GEOCHEMISTRY						
Lithium in Surficial Materials of the Continuous United States and Partial Data on Cadmium,						
W73-11268	5B					
Determination of Trace Mercury in Soil and Rock Media,						
W73-11297	5A					
Chemical Cycles with Energy Circuit Models,						
W73-11381	2A					
Role of Iron Sulfides in the Accumulation of Trace Elements in Black Sea Sediments (Role						

SUBJECT INDEX

GEOCHEMISTRY

sul'fidov zheleza pri nakoplenii mikroelementov v osadkakh Chernogo morya),
W73-11409 2J

Some Problems in the Geochemistry of Molybdenum in the Mediterranean Sea (Nekotorye voprosy geokhimii molibdena v Sredizemnom more),
W73-11410 2K

Conditions of Preservation of Chlorophyll, Pheophytin, and Humic Substances in Black Sea Sediments (Usloviya sokhranosti klorofilla, feofitina i guminovykh veshchestv v otlozheniyakh Chernogo morya),
W73-11411 2J

Distribution of Trace Elements in Bodies of Water of Kazakhstan (Raspredeleniye mikroelementov v vodoyemakh Kazakhstana),
W73-11413 2K

GEOCHRONOLOGY

Great Glaciations in the History of the Earth (Velikiye oledeneniya v istorii Zemli),
W73-11095 2C

GEOLOGIC FORMATIONS

Location and Determination of Depths of Sub-surface Undulations by Seismic Methods,
W73-11398 8E

GEOLOGIC TIME

Great Glaciations in the History of the Earth (Velikiye oledeneniya v istorii Zemli),
W73-11095 2C

Upper Permian Glaciomarine Deposits in the Kolyma River Basin (Verkhnepermkiye ledovo-morskiye otlozheniya basseyna istokov r. Kolomy),
W73-11103 2J

GEOLOGICAL SURVEYS

Location and Determination of Depths of Sub-surface Undulations by Seismic Methods,
W73-11398 8E

GEORGIA

Multilevel Control of Multipollutant System,
W73-11363 5G

Volume Transport, Salinity Distribution and Net Circulation in the Duplin Estuary, Georgia,
W73-11425 2L

Preimpoundment Study, Carters Lake.
W73-11530 6G

GEOTRICHUM CANDIDUM

Metal Toxicity to Sewage Organisms, A Discussion,
W73-11266 5D

GERMANY

Organochlorine Insecticides in Surface Waters in Germany-1970 and 1971,
W73-11628 5C

GILLS

Survival and Gill Condition of Bluegill (Lepomis macrochirus) and Fathead Minnows (Pimephales promelas) Exposed to Sodium Nitrilotriacetate (NTA) for 28 Days,
W73-11621 5C

GLACIAL DRIFT

Upper Permian Glaciomarine Deposits in the Kolyma River Basin (Verkhnepermkiye ledovo-morskiye otlozheniya basseyna istokov r. Kolomy),
W73-11103 2J

GLACIAL SEDIMENTS

Great Glaciations in the History of the Earth (Velikiye oledeneniya v istorii Zemli),
W73-11095 2C

Upper Permian Glaciomarine Deposits in the Kolyma River Basin (Verkhnepermkiye ledovo-morskiye otlozheniya basseyna istokov r. Kolomy),
W73-11103 2J

GLACIATION

Great Glaciations in the History of the Earth (Velikiye oledeneniya v istorii Zemli),
W73-11095 2C

GLACIER RETREAT

Rate of Retreat of Yuzhno-Chuya Glaciers in the Gorno-Alтай Autonomous Oblast (O skorosti otstupaniya lednikov Yuzhno-Chuyskikh belkov Gornogo Altaya),
W73-11097 2C

GLACIERS

A Principles Study of Factors Affecting the Hydrological Balance of the Lemon Glacier System and Adjacent Sectors of the Juneau Icefield, Southeastern Alaska, 1965-1969,
W73-11054 2C

Great Glaciations in the History of the Earth (Velikiye oledeneniya v istorii Zemli),
W73-11095 2C

Rate of Retreat of Yuzhno-Chuya Glaciers in the Gorno-Alтай Autonomous Oblast (O skorosti otstupaniya lednikov Yuzhno-Chuyskikh belkov Gornogo Altaya),
W73-11097 2C

Drainings of Ice-Dammed Summit Lake, British Columbia,
W73-11547 2E

GLACIOLOGY

Continuous Observations of the Structural Changes in Deforming Polycrystalline Ice,
W73-11556 2C

GRAB SAMPLER

An Improved Ekman-Type Grab,
W73-11659 5A

GRAB-SAMPLING

Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management,
W73-11150 5G

GRADIENT TECHNIQUES

Discrete Gradient Optimization of Water Systems,
W73-11365 8B

GRAND TRAVERSE BAY

Water Quality Models for Total Coliform,
W73-11135 5B

Spring Phytoplankton Abundance and Productivity in Grand Traverse Bay, Lake Michigan, 1970,
W73-11629 5B

GRANULAR CARBON FILTERS

Activated Carbon for Palatable Water: Granular or powdered.
W73-11422 5F

GRAPHICAL ANALYSIS

Estimating Well Costs.
W73-11476 8A

GRAPHICAL TECHNIQUES

Simulated Distillation of Narrow, High Boiling Hydrocarbon Fractions,
W73-11613 5A

GRASSES

The Response of Native Montana Grasses to Soil Water Stress,
W73-11429 2I

GRAVEL PACKING

Efficiency of Well Screens and Gravel Packs:
Final Report of Research Panel, No 6.
W73-11474 8D

GRAVELS

Efficiency of Well Screens and Gravel Packs:
Final Report of Research Panel, No 6.
W73-11474 8D

GRAVIMETRIC ANALYSIS

2,4,6-Triphenylpyridinium Chloride. A New Organic Analytical Reagent for the Determination of Certain Anions,
W73-11623 5A

GREENBELTS

Ecological and Physiological Implications of Greenbelt Irrigation - Phase I,
W73-11424 5D

GROUNDWATER

Groundwater Regime in the Zone of Influence of Pumping (Rezhim gruuntovykh vod v zone vliyaniya vertikal'nogo drenazha),
W73-11094 4B

Tritium Concentration of a Variety of Water Samples: Fifth Listing,
W73-11104 5B

Groundwater Levels in Nebraska, 1972,
W73-11120 4B

Calcite Saturation in an Eastern Kentucky Karst Stream,
W73-11391 2K

Water Records of the U.S. Virgin Islands, 1962-69,
W73-11396 2E

Hydrologic Records for Volusia County, Florida: 1971-72,
W73-11399 7C

Water Resources Inventory of Connecticut: Part 6. Upper Housatonic River Basin,
W73-11555 2A

GROUNDWATER MOVEMENT

Behavior of Groundwater Flow Subject to Time-Varying Recharge,
W73-11142 2F

A Small Dimension Probe for the Determination of Ground Water Flow Direction,
W73-11200 2F

Investigation of Infrared Anomalies in the Lac Des Deux Montagnes Area, Quebec,
W73-11541 7B

The Environmental Tritium Concentration of Underground Water and Its Hydrological Interpretation,
W73-11544 2F

Ground-Water Quality in Wisconsin Through 1972,
W73-11568 2F

SUBJECT INDEX

HEAVY METALS

GROUNDWATER RECHARGE		
Ground Water Recharge Through Pits and Wells, W73-11053	4B	
Behavior of Groundwater Flow Subject to Time-Varying Recharge, W73-11142	2F	
Stream Depletion Factors, Arkansas River Valley, Southeastern Colorado: A Basis for Evaluating Plans for Conjunctive Use of Ground and Surface Water, W73-11221	4B	
Emerging Water Supply Technology. W73-11246	3D	
Artificial Recharge of Groundwater, A Bibliography. W73-11321	4B	
Artificial Recharge in the Whitewater River Area, Palm Springs, California, W73-11565	4B	
GROUNDWATER RESOURCE		
Water Resources of Hempstead, Lafayette, Little River, Miller, and Nevada Counties, Arkansas, W73-11222	4B	
GROUNDWATER RESOURCES		
Groundwater Data in the Corvallis-Albany Area, Central Willamette Valley, Oregon, W73-11093	4B	
Ground Water in Finney County, Southwestern Kansas, W73-11106	7C	
Ground-water Basic Data of Cavalier and Pembina Counties, W73-11397	4B	
Availability of Groundwater for Public-Water Supply in Central and Southern Escambia County, Florida: Interim Report, July 1972, W73-11563	2F	
Ground-Water Quality in Wisconsin Through 1972, W73-11568	2F	
GROWTH		
The Effects of Temperature on Growth and Reproduction of Aquatic Snails, W73-11444	5C	
GROWTH RATES		
Metal Toxicity to Sewage Organisms, A Discussion, W73-11266	5D	
Effects of Logging on Growth of Juvenile Coho Salmon, W73-11433	5C	
Ferrous Iron and the Growth of Twenty Isolates of Phytophthora Infestans in Synthetic Media, W73-11490	5A	
Effects of Sublethal Concentrations of Sodium Pentachlorophenate on Growth Rate, Food Conversion Efficiency, and Swimming Performance in Underyearling Sockeye Salmon (<i>Oncorhynchus nerka</i>), W73-11656	5C	
GROWTH STAGES		
Copper Induced Lesions in Estuarine Teleosts, W73-11616	5C	
GULF OF MEXICO		
Coastal Dynamics along Mustang Island, Texas, W73-11081	2L	
GULF OF ST. LAWRENCE		
Dispersed and Particulate Petroleum Residues in the Gulf of St. Lawrence, W73-11612	5B	
HALOGENATED PESTICIDES		
Man's Role in the Major Sedimentary Cycle, W73-11382	5B	
HAMMER DRILLS		
Operation and Capability of the Becker Hammer Drill, W73-11470	8C	
HANFORD RESERVATION (WASH)		
Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington, W73-11204	5B	
HANOVER (WASH)		
Radioucnides in Transport in the Columbia River from Pasco to Vancouver, Washington, W73-11549	5B	
HARBOR PORPOISES		
Mercury in Harbour Porpoises (<i>Phocoena phocoena</i>) From the Bay of Fundy Region, W73-11588	5C	
HARBORS		
A Case History of Santa Cruz Harbor, California, W73-11092	8B	
Mobil Area Water Transportation Study of Mobile, Baldwin and Escambia Counties, Alabama, W73-11260	8A	
A Small Vacuum Oil Skimming System, W73-11436	5G	
Shore Termination for Oil Spill Booms, W73-11437	5G	
A Rapidly Deployable Oil Containment Boom for Emergency Harbor Use, W73-11439	5G	
HARDNESS (WATER)		
Method and Apparatus for Detecting the Hardness Level of Water, W73-11227	7B	
HARMONIC ANALYSIS		
Supplementation of Missing Values in Water Quality Data, W73-11687	5G	
HARRISBURG AREA (PENN)		
Effects of Roadway and Pond Construction on Sediment Yield Near Harrisburg, Pennsylvania, W73-11700	2J	
HATCHING		
Low pH Values Shown to Affect Developing Fish Eggs (<i>Brachydanio rerio</i> Ham.-Buch.), W73-11651	5C	
HAWAII		
Direct Determination of the Electromagnetic Reflection Properties of Smooth Brackish Water to the Continuous Spectrum from 100 million to 4 billion Hertz, W73-11052	2L	
An Investigation of Floods in Hawaii Through September 30, 1972,		
W73-11404	2E	
HAZARDOUS MATERIALS		
Control of Hazardous Chemical Spills by Physical Barriers, W73-11338	5G	
HEAT BALANCE		
A Principles Study of Factors Affecting the Hydrological Balance of the Lemon Glacier System and Adjacent Sectors of the Juneau Icefield, Southeastern Alaska, 1965-1969, W73-11054	2C	
HEAT EXCHANGE		
Centrifugal Distillation System, W73-11223	3A	
HEAT TRANSFER		
Tube Identifier, W73-11155	3A	
Numerical Thermal Plume Model for Vertical Outfalls in Shallow Water, W73-11333	5B	
Radiation, Evaporation and the Maintenance of Turbulence under Stable Conditions in the Lower Atmosphere, W73-11343	2D	
A Power Wind Law for Turbulent Transfer Computations, W73-11344	2D	
Computing Evapotranspiration by Geostrophic Drag Concept, W73-11345	2D	
Unified Formulation of Wall Turbulence, W73-11346	2D	
Sensitivity of the Solution for Heat Flux or Evaporation to Off-Diagonal Turbulent Diffusivities, W73-11347	2D	
Perturbation Solution of an Equation of Atmospheric Turbulent Diffusion, W73-11348	2D	
A Solution for Simultaneous Turbulent Heat and Vapor Transfer between a Water Surface and the Atmosphere, W73-11349	2D	
HEATED WATER		
Numerical Thermal Plume Model for Vertical Outfalls in Shallow Water, W73-11333	5B	
HEAVY METALS		
Composition of Airborne Lead Particles, W73-11188	5A	
Metal Toxicity to Sewage Organisms, A Discussion, W73-11266	5D	
The Lead Industry as a Source of Trace Metals in the Environment, W73-11269	5B	
An Investigation of Environmental Pollution by Lead and Other Heavy Metals from Industrial Development in Southeastern Missouri, W73-11270	5B	
Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri, W73-11271	5C	

SUBJECT INDEX

HEAVY METALS

Lead Accumulation Within Nuclei of Moss Leaf Cells, W73-11276	5E
Heavy Metals: Fallout Around a Power Plant, W73-11282	5A
Volcanic Exhalations and Metal Enrichments at Matupi Harbor, New Britain, T.P.N.G., W73-11292	5B
Lead Emissions from Incinerated Sewage Sludge Detected on Tree Foliage, W73-11302	5A
The Case Against Mercury, W73-11303	5C
Assessing the Water Pollution Potential of Manufactured Products, W73-11334	5B
Man's Role in the Major Sedimentary Cycle, W73-11382	5B
Trace Analysis by Enzyme Inhibition and Activation, W73-11604	5A
2,3-Dihydroxynaphthalene as Indicator for the Complexometric Titration of Iron (III) with EDTA, W73-11641	5A
Cycling of Elements of Estuaries, W73-11645	5B
Influence of Lead and Other Metals on Fish Delta-Aminolevulinate Dehydrase Activity, W73-11646	5A
The Heavy Metal Content of Rainfall in the East Midlands, W73-11648	5A
Sublethal Effects of Baltimore Harbor Water on the White Perch, Morone americana, and the Hogchoker, Trinectes maculatus, W73-11652	5C
HELICOPTER APPLICATION	
Helicopter Application of Copper Sulfate, W73-11419	5F
HELMINTHS	
Parasites of Fish from Lake of the Woods, Ontario, W73-11172	2I
HEMATOLOGY	
Effects of a 12-Hr and 25-Day Exposure to Kraft Pulp Mill Effluent on the Blood and Tissues of Juvenile Coho Salmon (Oncorhynchus kisutch), W73-11620	5C
HERBICIDES	
Progress Report of Residue Studies on Organic Arsenicals used for Ditchbank Weed Control, W73-11497	4A
Handbook of Toxic Chemicals (Second Edition, Revised and Supplemented), W73-11554	5C
The Influence of Simazine on the Photosynthetic Pigments of Green Algae, W73-11610	5C
HETEROCYCLIC HYDROCARBONS	
Chemical Oxygen Demand of Some Nitrogenous Heterocyclic Compounds, W73-11611	5A

HETEROTROPHY ANALYSIS

The Relationship of Enzyme Kinetic Heterotrophy Analysis to Other Eutrophication Indices, W73-11432	5C
--	----

HIGH FREQUENCY IMPEDIMENTRY

Volumetric Determination of Nickel by High Frequency Impedimentry, W73-11127	5A
---	----

HIGH TEMPERATURE APPLICATIONS

A Literature Survey--Performance of Exceptional Metals in Corrosive Environments, W73-11479	8G
--	----

HISTOLOGY

Sublethal Effects of Baltimore Harbor Water on the White Perch, Morone americana, and the Hogchoker, Trinectes maculatus, W73-11652	5C
--	----

HISTOPATHOLOGY

Copper Induced Lesions in Estuarine Teleosts, W73-11616	5C
--	----

Effects of a 12-Hr and 25-Day Exposure to Kraft Pulp Mill Effluent on the Blood and Tissues of Juvenile Coho Salmon (Oncorhynchus kisutch), W73-11620	5C
--	----

HOGCHOKERS

Sublethal Effects of Baltimore Harbor Water on the White Perch, Morone americana, and the Hogchoker, Trinectes maculatus, W73-11652	5C
--	----

HOMARUS AMERICANUS

Response of Lobsters Homarus americanus to Odor Solution in The Presence of Bleached Kraft Mill Effluent, W73-11619	5C
--	----

HORTICULTURAL CROPS

Freeze-Free (32 F) Seasons of the Major Basins and Plateaus of Nevada, W73-11218	7C
---	----

HOSE STREAMS

Use of Fire Streams to Control Floating Oil, W73-11435	5G
---	----

HOSTS

Pollution Effects on Phycovirus and Host Algal Ecology, W73-11635	5C
--	----

HOT SPRINGS

Ecology of Yellowstone Thermal Effluent Systems: Intersects of Blue-Green Algae, Grazing Flies (Paracoenia, Ephyrinidae) and Water Mites (Partunielia, Hydrachnellae), W73-11131	5C
---	----

HOUSTON (TEXAS)

Effects of Urbanization on Floods in the Houston, Texas, Metropolitan Area, W73-11402	4C
--	----

HUDSON BAY

Research and the Problems of Two Seas, W73-11350	2L
---	----

HUMAN DISEASES

Application of the Fluorescent Antibody Technique to the Differentiation of Aspergillus Species, Candida Species and Zygomycetes in Paraffin Section of Formalin-Fixed Tissues, W73-11126	5A
--	----

A Few Coastal Pollution Problems in Japan, W73-11376	5C
---	----

HUMAN PATHOLOGY

Trace Elements in the Human Environment, W73-11304	5B
---	----

Certain Biological Effects of Lead Upon the Animal Organism, W73-11307	5C
---	----

HUMIC ACIDS

Conditions of Preservation of Chlorophyll, Pheophytin, and Humic Substances in Black Sea Sediments (Usloviya sokhraneniya klorofilla, feofitsina i guminovykh veshchestv v otlozheniyakh Chernogo morya), W73-11411	2J
--	----

HUMUS

On The Age of Stable Organic Matter--Aquatic Humus in Oceanic Waters, W73-11379	5B
--	----

HYDRATE PROCESSES

The Growth Rate of Ice Crystals: The Properties of Carbon Dioxide Hydrate A Review of Properties of 51 Gas Hydrates, W73-11156	3A
---	----

HYDRATING AGENTS

The Growth Rate of Ice Crystals: The Properties of Carbon Dioxide Hydrate A Review of Properties of 51 Gas Hydrates, W73-11156	3A
---	----

HYDRAULIC CONDUCTIVITY

Use of Physical Methods to Expand Soil Survey Interpretations of Soil Drainage Conditions, W73-11210	2G
---	----

Relationships Between Saturated Hydraulic Conductivity and Morphometric Data of an Argillic Horizon, W73-11211	2G
---	----

HYDRAULIC FRACTURING

Oil Field Techniques Used to Increase Flow in Community Water Well, W73-11465	8A
--	----

HYDRAULIC MACHINERY

Oil Field Techniques Used to Increase Flow in Community Water Well, W73-11465	8A
--	----

HYDRAULIC MODELS

Hydraulics of Shallow Flows Over Stable Eroded Sand Surfaces Defined by Area Spectra, W73-11192	2A
--	----

Hydraulic Design of Stilling Basin for Pipe or Channel Outlets, W73-11533	8B
--	----

Simultaneous, Multiple-Level Release from Stratified Reservoirs, W73-11567	8B
---	----

HYDRAULIC STRUCTURES

Rehabilitation of Irrigation Systems for Salinity Control, W73-11509	3F
---	----

Study for Improvement of Monte Sano Bayou from Airline Highway to Mississippi River East Branch Rouge Parish, Louisiana. W73-11682	8A
---	----

HYDRAULICS

River Systems Transition Function and Operation Study, W73-11364	4A
---	----

SUBJECT INDEX

ICEBERG TOWING

HYDROBIOLOGY	
Applications of Multispectral Remote Sensing Techniques to Hydrobiological Investigations in Everglades National Park,	
W73-11553	7B
HYDROCYCLONES	
Development of a Mobile System for Cleaning Oil-Contaminated Beaches,	
W73-11064	5G
HYDRODYNAMICS	
Coastal Dynamics along Mustang Island, Texas,	
W73-11081	2L
Membrane Fouling in Electrodialysis: A Model and Experiments,	
W73-11163	3A
HYDROFRACTURING	
Numerical Techniques Applied to Particle Deposition During Slot Flow,	
W73-11697	2J
HYDROGEN ION CONCENTRATION	
Carbon Dioxide Dynamics: A Record of Organic Carbon Production, Respiration, and Calcification in the Eniwetok Reef Flat Community,	
W73-11488	5A
Low Cost Multichannel Scanning pH-Stat,	
W73-11492	5A
Continuous Culture of Rhodotorula rubra: Kinetics of Phosphate-Arsenate Uptake, Inhibition, and Phosphate-Limited Growth,	
W73-11574	5A
Planktonic Changes Following the Restoration of Lake Trumen, Sweden,	
W73-11639	5G
Low pH Values Shown to Affect Developing Fish Eggs (<i>Brachydanio rerio</i> Ham.-Buch.),	
W73-11651	5C
HYDROGEN SULFIDE REMOVAL	
H ₂ S Removal from Water Without Air Pollution,	
W73-11314	5F
HYDROGEOCHEMICAL CYCLING	
The Acceleration of the Hydrogeochemical Cycling of Phosphorus,	
W73-11385	5B
HYDROGEOLOGIC EVALUATIONS	
The Need for Hydrogeologic Evaluations in a Mine Drainage Abatement Program: A Case Study, Toms Run, Clarion County, Pennsylvania,	
W73-11674	5G
HYDROGEOLOGY	
Ground Water in Finney County, Southwestern Kansas,	
W73-11106	7C
Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington,	
W73-11204	5B
Ground-Water Quality in Wisconsin Through 1972,	
W73-11568	2F
The Need for Hydrogeologic Evaluations in a Mine Drainage Abatement Program: A Case	
Study, Toms Run, Clarion County, Pennsylvania,	
W73-11674	5G
Hydrogeologic Considerations for Sealing Coal Mines,	
W73-11675	5G
HYDROGRAPH ANALYSIS	
Precomputation of a Spring-Flood Hydrograph Based on Hydrometeorological Data (Predvychisleniye gidrografov vesennego polovoda po gidrometeorologicheskim dannym),	
W73-11689	2E
HYDROGRAPHS	
Precomputation of a Spring-Flood Hydrograph Based on Hydrometeorological Data (Predvychisleniye gidrografov vesennego polovoda po gidrometeorologicheskim dannym),	
W73-11689	2E
HYDROLOGIC DATA	
A Catalog of Hydroclimatological Data for Alaska's Coastal Zone,	
W73-11056	2B
Annual Compilation and Analysis of Hydrologic Data for Urban Studies in the Fort Worth, Texas, Metropolitan Area, 1971,	
W73-11215	4C
Water Resources of Hempstead, Lafayette, Little River, Miller, and Nevada Counties, Arkansas,	
W73-11222	4B
Hydrologic Records for Volusia County, Florida: 1971-72,	
W73-11399	7C
Preliminary Study, Carters Lake.	
W73-11530	6G
Bathymetric Reconnaissance of Lake Tahoe, Nevada and California,	
W73-11531	2H
Reservoir Bank Storage,	
W73-11542	2H
HYDROLOGIC MODELS	
The Estimation of the Hydrologic Impact of Urbanization: An Example of the Use of Digital Simulation in Hydrology,	
W73-11259	4C
HYDROLOGIC SYSTEMS	
Behavior of Groundwater Flow Subject to Time-Varying Recharge,	
W73-11142	2F
Electrical-Analog Model Study of a Hydrologic System in Southeast Florida,	
W73-11570	2A
HYDROLOGY	
Disaggregation Processes in Stochastic Hydrology,	
W73-11141	2E
Hydrology of Truckee Meadows, Nevada,	
W73-11430	4B
HYDROLYSIS	
Spray Freezing, Decanting, Melting and Hydrolysis as Related to Secondary Refrigerant Desalting,	
W73-11158	3A
HYDROSTATIC PRESSURE	
Abnormal Pressures in Deep Wells of Southwestern Louisiana,	
W73-11464	8E
IBERIAN PENINSULA	
Minimum Flow in the Iberian Peninsula (Minimal'nyy stok rek Pireneyskogo polusotrova),	
W73-11098	2E
ICE	
Spray Freezing, Decanting, Melting and Hydrolysis as Related to Secondary Refrigerant Desalting,	
W73-11158	3A
Research and the Problems of Two Seas,	
W73-11350	2L
Crude Oil Behavior on Arctic Winter Ice,	
W73-11539	5B
Continuous Observations of the Structural Changes in Deforming Polycrystalline Ice,	
W73-11556	2C
Characteristics of Ice-Jam Formation on the Soviet Reach of the Danube (Osobennosti zatoroobrazovaniya na sovetskem uchastke Dunaya),	
W73-11694	2C
Forecasting Time of Formation of Complete Ice Cover in the Upper Dnieper Basin (O prognozirovaniyu srokov nastupleniya ledostava v basseyne Verkhnego Dnepra),	
W73-11695	2C
ICE COVER	
Organic Loading of Petenwell Reservoir, Wisconsin,	
W73-11486	5C
Forecasting Time of Formation of Complete Ice Cover in the Upper Dnieper Basin (O prognozirovaniyu srokov nastupleniya ledostava v basseyne Verkhnego Dnepra),	
W73-11695	2C
ICE CRYSTAL GROWTH	
The Growth Rate of Ice Crystals: The Properties of Carbon Dioxide Hydrate A Review of Properties of 51 Gas Hydrates,	
W73-11156	3A
ICE-DAMMED LAKES	
Drainings of Ice-Dammed Summit Lake, British Columbia,	
W73-11547	2E
ICE DEFORMATION	
Continuous Observations of the Structural Changes in Deforming Polycrystalline Ice,	
W73-11556	2C
ICE JAMS	
Characteristics of Ice-Jam Formation on the Soviet Reach of the Danube (Osobennosti zatoroobrazovaniya na sovetskem uchastke Dunaya),	
W73-11694	2C
ICE LOADS	
Ice Forces on Vertical Piles,	
W73-11538	8B
ICEBERG TOWING	
Towing Icebergs to Irrigate Arid Lands—Manna or Madness,	
W73-11566	6F

SUBJECT INDEX

ICEBERGS

ICEBERGS
Towing Icebergs to Irrigate Arid Lands--Manna or Madness,
W73-11566 6F

ICTLALURUS NEBULOSUS
Acute and Long-Term Accumulation of Copper by the Brown Bullhead, Ictalurus Nebulosus,
W73-11593 5C

ILLINOIS
Regional Waste Water, Solid Waste Disposal, Water Supply, and Storm Drainage Systems Appraisal.
W73-11252 5G

Public Utilities in Winnebago County.
W73-11263 3D

Incidence of Mercury in Illinois Pheasants,
W73-11305 5A

H₂S Removal from Water Without Air Pollution,
W73-11314 5F

IMPERVIOUS BLANKETS
Bituminous Blanket for Dike at Ludington Pumped Storage Project,
W73-11504 8F

IMPORTED WATER
Artificial Recharge in the Whitewater River Area, Palm Springs, California,
W73-11565 4B

IMPOUNDED WATERS
Limnology of Yellowtail Reservoir and the Big Horn River,
W73-11331 5C

INACTIVATION
Spectrophotometric Method for Determination of Ozone in Aqueous Solutions,
W73-11495 5A

INCINERATION
Lead Emissions from Incinerated Sewage Sludge Detected on Tree Foliage,
W73-11302 5A

INDEXING
Environmental Terminology Index.
W73-11387 10C

INDIA
Analysis of Soil Temperatures in the Arid Zone of India by Fourier Techniques,
W73-11177 2G

INDIA (IB WATERSHED)
Morphology and Distribution of Soils of Lower Ib Watershed,
W73-11258 2G

INDIANA
Areawide Trace Metal Concentrations Measured by Multielement Neutron Activation Analysis - A One Day Study in Northwest Indiana,
W73-11278 5B

Ozonation at Whiting: 26 Years Later,
W73-11316 5F

INDICATORS
Application of Radiochemical Methods in Environmental Research, (Anwendung Radiochemischer Methoden in der Umweltforschung),
W73-11125 5A

INDUSTRIAL WASTES

Cannery Wastewater Treatment with Rotating Biological Contactor and Extended Aeration,
W73-11058 5D

Aerobic Secondary Treatment of Plywood Glue Wastes,
W73-11065 5D

Industrial Waste Survey, Dade County, Florida.
W73-11217 5B

Liquid Sampling,
W73-11235 7B

The Lead Industry as a Source of Trace Metals in the Environment,
W73-11269 5B

Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri,
W73-11271 5C

Curtailing Pollution from Metal Finishing,
W73-11283 5D

Cell Systems Keep Mercury From Atmosphere.
W73-11287 5G

Chlorine Makers Clutch at Last Drops of Mercury.
W73-11288 5D

A Study of the Photodegradation of Commercial Dyes,
W73-11325 5B

Assessing the Water Pollution Potential of Manufactured Products,
W73-11334 5B

Economic Feasibility of Minimum Industrial Waste Load Discharge Requirements,
W73-11335 5D

Secondary Waste Treatment for a Small Diversified Tannery,
W73-11340 5D

National Meat-Packaging Waste Management Research and Development Program,
W73-11440 5D

Report on Evaluations of Waste Sources in the Calcasieu River Basin, Louisiana.
W73-11529 5B

Disposal of Uranium-Mill Effluent by Well Injection in the Grants Area, Valencia County, New Mexico,
W73-11551 5E

INDUSTRIAL WATER
The Role of Desalting in Providing High Quality Water for Industrial Use,
W73-11164 3A

INDUSTRIAL WATER USERS
The Role of Desalting in Providing High Quality Water for Industrial Use,
W73-11164 3A

INFANT MORTALITY
Infant Mortality and Hardness of Local Water Supplies,
W73-11144 5C

INFILTRATION
Simultaneous Transport of Chloride and Water During Infiltration,
W73-11213 2K

Supplement to City of Albuquerque Sandia Foothills Drainage Study.
W73-11669 4A

INFILTRATION GALLERIES

Radial Collector Well Solves Water Supply Problem,
W73-11473 8B

INFILTRATION RATE
Water Infiltration Under Center-Pivot Sprinklers,
W73-11514 8B

INFLOW

Inflow to Rivers in the Pamirs (Pitaniye rek Pamira),
W73-11096 2C

Probabilistic Short-Term River Yield Forecasts,
W73-11366 4A

Forecasting Quarterly Inflow of Water to Dnieper River Reservoirs During the Cold Half of the Year (O prognozirovaniu kvartal'nogo pritoka vody v dneprovskiy vodokhranilishcha za kholodnyyu polovinu goda),
W73-11691 2H

INFORMATION CENTERS

Operation of the Analytical Methodology Information Center,
W73-11336 5A

INFORMATION RETRIEVAL

Operation of the Analytical Methodology Information Center,
W73-11336 5A

INFRARED RADIATION

The Inference of Atmospheric Ozone Using Satellite Nadir Measurements in the 1042/CM Band,
W73-11400 7B

Investigation of Infrared Anomalies in the Lac Des Deux Montagnes Area, Quebec,
W73-11541 7B

INFRARED SPECTRA

Quantitative Infrared Spectrophotometry of Organic Nitrate Esters,
W73-11600 5A

INFRARED SPECTROPHOTOMETRY

Quantitative Infrared Spectrophotometry of Organic Nitrate Esters,
W73-11600 5A

INHIBITION

Metal Toxicity to Sewage Organisms, A Discussion,
W73-11266 5D

Trace Analysis by Enzyme Inhibition and Activation,
W73-11604 5A

Influence of Lead and Other Metals on Fish Delta-Aminolevulinate Dehydrase Activity,
W73-11646 5A

INJECTION WELLS

Ground Rupture in the Baldwin Hills,
W73-11206 5E

Disposal of Uranium-Mill Effluent by Well Injection in the Grants Area, Valencia County, New Mexico,
W73-11551 5E

SUBJECT INDEX

IRRIGATION WATER

Numerical Techniques Applied to Particle Deposition During Slot Flow,	2J	INTERNATIONAL HYDROLOGICAL DECADE	
W73-11697		Urban Hydrology for the Period Up to December 1971.	
		W73-11698	4C
INSECT CONTROL		INTERSTATE COMMISSIONS	
The Effects of Ditching on the Mosquito Populations in Some Sections of Juncus Salt Marsh in Carteret County, North Carolina,		The Evolving Role of the Federal Government in the Management of Lake Michigan,	
W73-11431	4A	W73-11247	6E
INSECTICIDES		INVERTEBRATES	
Fluorescent Probes in the Detection of Insecticides in Water,		Effects of Chemical Variations in Aquatic Environments: Volume I, Biota and Chemistry of Picance Creek,	
W73-11061	5A	W73-11074	5C
Clean-Up of Crude Extracts Containing Pesticide Residues by an Automatic Apparatus Based Upon the Principle of "Sweep Co-Distillation, (Reinigung Pesticiddruckstange Enthal-tender Rohextrakte Mit Einer Automatisch Arbeitenden Apparatur Nach Dem Prinzip der Kombinierten Spülund Codestillation (Sweep Codistillation)),		A Study of a Small Tropical Lake Treated With the Molluscicide Frescon,	
W73-11124	5A	W73-11614	5C
INSTALLATION		INVESTMENT	
Design and Installation of Deep Anode Groundbeds,		A Dynamic programming approach for Investment Strategies in Wastewater Treatment Plants,	
W73-11480	8B	W73-11426	5D
INSTRUMENTATION		Financing Private Water Resource Development: Analysis of a State Loan Program,	
A Continuous-Flow Apparatus for Assessing the Toxicity of Substances to Marine Animals,		W73-11686	3F
W73-11169	5C	ION EXCHANGE	
Precision and Detection Limits of Cadmium, Manganese, Cobalt, and Nickel in Sulfides by Electron Microprobe Analysis,		Ion Transport Through Layered Ion Exchange Membranes,	
W73-11178	5A	W73-11160	3A
A Small Dimension Probe for the Determination of Ground Water Flow Direction,		De-Oiling of Polluted Waters,	
W73-11200	2F	W73-11226	5D
Atomic Absorption Spectrophotometry as a Tool for the Water Chemist,		Analysis of Sea Water by Difference Chromatography. Summary of Progress 1972,	
W73-11294	5A	W73-11584	5A
Atomic Absorption Spectrophotometry in the Field of Marine Research,		ION EXCHANGE RESINS	
W73-11298	5A	Anion Exchange Separations of the Elements Extractable with Tributyl Phosphate. IV, (Anionenaustauschtrennungen der Mit Tributylphosphat Extrahierbaren Elemente. IV),	
The U.C.S. Grain-Size Comparator Disc,		W73-11122	5A
W73-11395	7B	ION-SELECTIVE MEMBRANES	
Improved Double Detection Gas Chromatograph-Mass Spectrometer Interface for the Analysis of Complex Organic Mixtures,		Apparatus for Use in an Improved Electro-Dialysis Process,	
W73-11663	5A	W73-11230	3A
INTANGIBLE BENEFITS		ION TRANSPORT	
Aesthetic Preference for Water Resource Projects: An Application of Q Methodology,		Research on Reverse Osmosis Membranes for Purification of Wash Water at Sterilization Temperature (165°F),	
W73-11684	6B	W73-11159	3A
INTERCONNECTED SYSTEMS		Ion Transport Through Layered Ion Exchange Membranes,	
Solution of Problems on Interconnected AC Systems by Means of HVDC Transmission Systems,		W73-11160	3A
W73-11521	8C	Investigation of Phase and State Relations in Complex Lipid Systems,	
INTERNATIONAL ASSOCIATION OF SCIENTIFIC HYDROLOGY (IASH)		W73-11161	3A
Information on Activities of the Commission on Surface Waters of the International Association of Scientific Hydrology (IASH) (Informatsiya o rabote komissii poverkhnostnykh vod Mezhdunarodnoy assotsiatsii nauchnykh hidrologov (MANG)),		IONIZATION	
W73-11414	2A	Apparatus for Treating Sewage,	
		W73-11231	5D
IRISH SEA		IOWA	
Distribution of Dissolved Mercury in the Irish Sea,		Phosphorus Losses From Four Agricultural Watersheds on Missouri Valley Loess,	
W73-11293	5B	W73-11209	5B
IRRIGATION WATER		IRRIGATION ENGINEERING	
Colorado River Water Quality Improvement Program.		Water Infiltration Under Center-Pivot Sprinklers,	
W73-11264	5G	W73-11514	8B
IRRIGATION PRACTICES		IRRIGATION PROGRAMS	
Influence of Agricultural Practices on Water Quality in Nebraska: A Survey of Streams, Groundwater, and Precipitation,		Financing Private Water Resource Development: Analysis of a State Loan Program,	
W73-11696	5B	W73-11686	3F
IRRIGATION SYSTEMS		IRRIGATION WATER	
Prediction Modeling for Salinity Control in Irrigation Return Flows,		Colorado River Water Quality Improvement Program.	
W73-11441	5G	W73-11264	5G

SUBJECT INDEX

IRRIGATION WATER

Hydrology of Truckee Meadows, Nevada, W73-11430	4B
IRRIGATION WELLS	
The Biggest Artesian Well in the World, W73-11481	8A
ISLANDS	
Coastal Dynamics along Mustang Island, Tex- as, W73-11081	2L
ISOLATION	
Isolation of Salmonellae from Moderately Pol- luted Waters, W73-11134	5A
ITAL-ITAL DISEASE	
A Few Coastal Pollution Problems in Japan, W73-11376	5C
JAMAICA BAY (NY)	
A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. V, Jamaica Bay Rainstorms, W73-11351	5B
JAMES BAY	
Research and the Problems of Two Seas, W73-11350	2L
JAPAN	
A Few Coastal Pollution Problems in Japan, W73-11376	5C
JAPAN (LAKE BIWA)	
Epidemiological Study on <i>Clondorchis sinensis</i> Around Lake Biwa, Shiga Prefecture: I. Survey on Distribution of <i>Parafossarulus Manchou- ricus</i> , The First Intermediate Host Snail (In Japanese), W73-11654	2H
JETS	
Use of Fire Streams to Control Floating Oil, W73-11435	5G
Removal of Oil From Under Piers, W73-11438	5G
JORDANELLA FLORIDAE	
A Cyprinodontid Fish, <i>Jordanella Floridae</i> , as a Laboratory Animal for Rapid Chronic Bioassays, W73-11598	5C
JUNCUS-EFFUSUS-M	
Plant Communities of Wet Ground in Northeast Cheshire, England, W73-11552	2L
JUNEAU ICEFIELDS	
A Principle Study of Factors Affecting the Hydrological Balance of the Lemon Glacier System and Adjacent Sectors of the Juneau Icefield, Southeastern Alaska, 1965-1969, W73-11054	2C
JUVENILE FISH	
Effects of a 12-Hr and 25-Day Exposure to Kraft Pulp Mill Effluent on the Blood and Tis- sues of Juvenile Coho Salmon (<i>Oncorhynchus</i> <i>kisutch</i>), W73-11620	5C
Identification of the Constituents of Kraft Pulping Effluent That are Toxic to Juvenile Coho Salmon (<i>Oncorhynchus kisutch</i>), W73-11638	5A

KANSAS	
Ground Water Recharge Through Pits and Wells, W73-11053	4B
Ground Water in Finney County, Southwestern Kansas, W73-11106	7C
KARST	
Karst Landscapes and Karst Forms (<i>Karstovyye landshafty i tipy karsta</i>), W73-11102	4A
KARST HYDROLOGY	
Karst Landscapes and Karst Forms (<i>Karstovyye landshafty i tipy karsta</i>), W73-11102	4A
KARST TOPOGRAPHY	
Karst Landscapes and Karst Forms (<i>Karstovyye landshafty i tipy karsta</i>), W73-11102	4A
KENTUCKY	
Secondary Waste Treatment for a Small Diver- sified Tannery, W73-11340	5D
Capillary-Diffusion and Self-Diffusion of Liquid Water in Unsaturated Soils, W73-11390	2G
Calcite Saturation in an Eastern Kentucky Karst Stream, W73-11391	2K
KINETICS	
Characterization of the Activated Sludge Process, W73-11069	5D
A Neutron Spectroscopic Study of the Diffu- sive Kinetics and Interactions of Water in Dense Layer Desalination Membranes, W73-11165	3A
The Chemical Stability of the Oceans and the CO ₂ System, W73-11374	2K
Spectrophotometric Method for Determination of Ozone in Aqueous Solutions, W73-11495	5A
Continuous Culture of <i>Rhodotorula rubra</i> : Kinetics of Phosphate-Arsenate Uptake, Inhibi- tion, and Phosphate-Limited Growth, W73-11574	5A
LABORATORY ANIMALS	
A Cyprinodontid Fish, <i>Jordanella Floridae</i> , as a Laboratory Animal for Rapid Chronic Bioassays, W73-11598	5C
LABORATORY EQUIPMENT	
Clean-Up of Crude Extracts Containing Pesti- cide Residues by an Automatic Apparatus Bas- ing Upon the Principle of 'Sweep Co-Distilla- tion, (Reinigung Pesticiddruckstande Enthal- tender Rohextrakte Mit Einer Automatischen Ar- beitenden Apparatur Nach Dem Prinzip der Kombinierten Spül und Codestillation (Sweep Codistillation)), W73-11124	5A
Gas Chromatograph Peaks Identified On-Line by a New Grating Infrared Spectrophotometer, W73-11609	5A
LABORATORY TESTS	
Development and Preliminary Design of a Sor- bent-Oil Recovery System, W73-11071	5G
Transfer of Metallic Mercury into the Foetus, W73-11274	5B
Procedure Improved for Determining Corrosion Rate by Weight Loss, W73-11478	8G
Comparison of Selective Ion Monitoring and Repetitive Scanning During Gas Chromatogra- phy-Mass Spectrometry, W73-11493	5A
Effect of Chlorine on Fluorescent Dyes, W73-11597	5C
A Cyprinodontid Fish, <i>Jordanella Floridae</i> , as a Laboratory Animal for Rapid Chronic Bioassays, W73-11598	5C
A Colorimetric Technique Suggested for Chemical Oxygen Demand Determination, W73-11599	5A
LACTOSE FERMENTATION	
Investigations into the Occurrence of Coliform Organisms from Pristine Streams, W73-11428	5B
LAKE BAYKAL	
Preservation of Lake Baykal (Ob okhrane ozera Baykal), W73-11407	5C
LAKE ERIE	
Analysis of Lake Erie Wave Pressure Data, W73-11548	8B
LAKE HURON	
Effects of Submerged Sills in the St. Clair River, W73-11089	8B
LAKE LANSING (MICH)	
Major and Trace Element Loading of Central Michigan Lakes, W73-11427	5B
LAKE MICHIGAN	
Water Quality Models for Total Coliform, W73-11135	5B
The Evolving Role of the Federal Government in the Management of Lake Michigan, W73-11247	6E
Progress Report on Water Quality of Lake Michigan Near Chicago, W73-11581	5B
LAKE MORPHOLOGY	
Bathymetric Reconnaissance of Lake Tahoe, Nevada and California, W73-11531	2H
LAKE OF THE WOODS	
Parasites of Fish from Lake of the Woods, On- tario, W73-11172	2I
LAKE SEDIMENTS	
Phosphorus Release from Lake Sediments, W73-11072	5C
Major and Trace Element Loading of Central Michigan Lakes, W73-11427	5B

SUBJECT INDEX

LIMNOLOGY

Determination of Carbohydrate in Lake Sediment by a Modified Phenol-Sulfuric Acid Method,	5A	LAOS (MEKONG BASIN)	Certain Biological Effects of Lead Upon the Animal Organism,
W73-11482		Studies on Schistosomiasis in Mekong Basin:	W73-11307
Measurement of Exchangeable Inorganic Phosphate in Lake Sediments,	5A	II. Malacological Investigations on Human Schistosoma from Laos,	5C
W73-11596		W73-11633	
LAKE ST. CLAIR RIVER		LARGEMOUTH BASS	Biochemical Tests for the Appraisal of Exposure to Lead,
Effects of Submerged Sills in the St. Clair River,	8B	Development of Dissolved Oxygen Criteria for Freshwater Fish,	W73-11309
W73-11089		W73-11327	5C
LAKE SUPERIOR		LARVAE	Man's Role in the Major Sedimentary Cycle,
Circulation Patterns in Lake Superior,	2H	A Centrifuge Method for Determining Live Weights of Aquatic Insect Larvae, with a Note on Weight Loss in Preservative,	W73-11382
W73-11342		W73-11647	5B
LAKE TAHOE (CALIF AND NEV)		LC-MASS SPECTROMETRY	The Occurrence and Seasonal Variation of Trace Metals in the Scallops <i>Pecten maximus</i> (L.) and <i>Chlamys opercularis</i> (L.),
Bathymetric Reconnaissance of Lake Tahoe, Nevada and California,	2H	New Picogram Detection System Based on a Mass Spectrometer With an External Ionization Source at Atmospheric Pressure,	W73-11624
W73-11531		W73-11608	5A
LAKES		LEACHING	LEAF ELONGATION
Accretion Rates of Freshwater Manganese Deposits,	2J	Leaf Processing in a Woodland Trout Stream,	The Response of Native Montana Grasses to Soil Water Stress,
W73-11088		W73-11112	W73-11429
Preservation of Lake Baykal (Ob okhrane ozera Baykal),	5C	Effect of Soil, Cover, Slope, and Rainfall Factors on Soil and Phosphorus Movement Under Simulated Rainfall Conditions,	2I
W73-11407		W73-11208	
Distribution of Trace Elements in Bodies of Water of Kazakhstan (Raspredeleniye mikroelementov v vodoyemakh Kazakhstana),	2K	Simultaneous Transport of Chloride and Water During Infiltration,	LEAKAGE
W73-11413		W73-11213	Man's Role in the Major Sedimentary Cycle,
Major and Trace Element Loading of Central Michigan Lakes,	5B	LEAVES	W73-11382
W73-11427		Leaf Processing in a Woodland Trout Stream,	5B
Remote Sensing Evaluation of Environmental Factors Affecting the Developmental Capacity of Inland Lakes,	7B	W73-11112	
W73-11540		LEGISLATION	LEAPOMIS MACROCHIRUS
Drainings of Ice-Dammed Summit Lake, British Columbia,	2E	Composition of Airborne Lead Particles,	Survival and Gill Condition of Bluegill (<i>Lepomis macrochirus</i>) and Fathead Minnows (<i>Pimephales promelas</i>) Exposed to Sodium Nitritotriacetate (NTA) for 28 Days,
W73-11547		W73-11188	W73-11621
LAND		Prague International Lead Panel: Effects of Atmospheric Lead on Biological Systems,	5C
Land Spreading, A Conserving and Non-Polluting Method of Disposing of Oily Wastes,	5E	W73-11265	
W73-11535		Environmental Contamination by Lead from a Mine and Smelter,	LETHAL LIMIT
LAND MANAGEMENT		W73-11267	Environmental Effects on Toxaphene Toxicity to Selected Fishes and Crustaceans,
Natural Resource Information System Remote Sensing Studies,	7B	An Investigation of Environmental Pollution by Lead and Other Heavy Metals from Industrial Development in Southeastern Missouri,	W73-11323
W73-11571		W73-11270	5C
LAND SPREADING (OIL WASTE)		Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri,	LIDAR
Land Spreading, A Conserving and Non-Polluting Method of Disposing of Oily Wastes,	5E	W73-11271	Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering,
W73-11535		Lead Contamination of Snow,	W73-11631
LAND-USE		W73-11275	5A
An Economic Analysis of Flood Damage Reduction Alternatives in the Minnesota River Basin,	6F	Lead Accumulation Within Nuclei of Moss Leaf Cells,	LIGHT PENETRATION
W73-11055		W73-11276	Limnology of Yellowtail Reservoir and the Big Horn River,
Effects of Land Use and Retention Practices on Sediment Yields in the Stony Brook Basin, New Jersey,	4C	W73-11270	W73-11331
W73-11113		Lead Pollution from a Factory Manufacturing Anti-Knock Compounds,	5C
LANDSLIDES		W73-11290	
Principles of Landslide Identification from Aerial Survey Data (Printsyipy raspoznavaniya opolznevyykh protsessov po materialam aerofotos'yemki),	2J	Auto Exhaust - Lead Vs Aromatics,	LIMNOLOGY
W73-11100		W73-11301	Simplified Computer Approach to the Ultimate Load Analysis and Design of Reinforced Concrete Frames,
		Lead Emissions from Incinerated Sewage Sludge Detected on Tree Foliage,	W73-11499
		W73-11302	8F
		5A	Bathymetric Reconnaissance of Wild Horse Reservoir, Elko County, Nevada,
			W73-11219
			7C
			Bathymetric Reconnaissance of Weber Reservoir, Mineral County, Nevada,
			W73-11220
			7C
			Remote Sensing Evaluation of Environmental Factors Affecting the Developmental Capacity of Inland Lakes,
			W73-11540
			7B

SUBJECT INDEX

LINEAR INTERPOLATION

LINEAR INTERPOLATION
Supplementation of Missing Values in Water Quality Data, W73-11687 5G

LINEAR PROGRAMMING

Programing Model for Evaluating Economic and Financial Feasibility of Irrigation Projects with Extended Development Periods, W73-11149 3F

Linear Programming use for Evaluating Water Resources and Cost and Benefit Allocation, W73-11683 6A

LIPID MEMBRANES

Investigation of Phase and State Relations in Complex Lipid Systems, W73-11161 3A

LIPIDS

Investigation of Phase and State Relations in Complex Lipid Systems, W73-11161 3A

Arsenic in the Lipid Extracts of Marine Invertebrates, W73-11189 5C

LITHIUM

Lithium in Surficial Materials of the Contiguous United States and Partial Data on Cadmium, W73-11268 5B

LITHOLOGIC LOGS

Typical Log-Curve Shapes Indicate Formation Characteristics, W73-11456 8A

LITTORAL DRIFT

A Case History of Santa Cruz Harbor, California, W73-11092 8B

Sand Movement Along Carmel River State Beach, Carmel, California, W73-11557 2L

LIVE WEIGHTS

A Centrifuge Method for Determining Live Weights of Aquatic Insect Larvae, with a Note on Weight Loss in Preservative, W73-11647 5A

LOBSTERS

Response of Lobsters *Homarus americanus* to Odor Solution in The Presence of Bleached Kraft Mill Effluent, W73-11619 5C

LOUISIANA

Report on Evaluations of Waste Sources in the Calcasieu River Basin, Louisiana, W73-11529 5B

LOW FLOW

Minimum Flow in the Iberian Peninsula (Minimal'nyy stok rek Pireneyskogo polus-trova), W73-11098 2E

A Study of the Flint River, Michigan, as it Relates to Low-Flow Augmentation, W73-11207 5G

LOW-FLOW AUGMENTATION

A Study of the Flint River, Michigan, as it Relates to Low-Flow Augmentation, W73-11207 5G

LOW FLOW FREQUENCY

Minimum Flow in the Iberian Peninsula (Minimal'nyy stok rek Pireneyskogo polus-trova), W73-11098 2E

LUMBERING

Effects of Logging on Growth of Juvenile Coho Salmon, W73-11433 5C

Effects of Logging on Periphyton in Coastal Streams of Oregon, W73-11582 5C

MACROINVERTEBRATES

Macrobenthic Ecology of a Sawdust-Bearing Substrate in the Penobscot River Estuary (Maine), W73-11602 5C

MICROPHYTES

Plant Analysis for Nutrient Assay of Natural Waters, W73-11057 5C

MAINE

The Northern Maine Regional Treatment System, W73-11079 5D

MAIZE-M

Comparison of Simulated and Actual Evaporation From Maize and Soil in a Lysimeter, W73-11201 2D

MALACOLOGICAL STUDIES

Studies on Schistosomiasis in Mekong Basin: II. Malacological Investigations on Human Schistosomes from Laos, W73-11633 5C

MALONEY CANYON (CALIF)

Ecological and Physiological Implications of Greenbelt Irrigation - Phase I, W73-11424 5D

MANAGEMENT

Progressive Taxation as a Policy for Water Quality Management, W73-11147 5G

Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management, W73-11150 5G

Stochastic Reservoir Management and System Design for Irrigation, W73-11152 3F

Research and Development in Water Resources, Water Resources Research, Its Role in the Total R and D Spectrum, W73-11341 6B

National Meat-Packaging Waste Management Research and Development Program, W73-11440 5D

MANGANESE

Accretion Rates of Freshwater Manganese Deposits, W73-11088 2J

Manganese Nodules and Budget of Trace Solubles in Oceans, W73-11384 5B

The Occurrence and Seasonal Variation of Trace Metals in the Scallops *Pecten maximus* (L.) and *Chlamys opercularis* (L.), W73-11624 5A

The Accumulation from Water of ZN-65, MN-54, CO-58, and FE-59 by the Mussel, *Mytilus edulis*, W73-11625 5A

MANGANESE NODULES

Accretion Rates of Freshwater Manganese Deposits, W73-11088 2J

Manganese Nodules and Budget of Trace Solubles in Oceans, W73-11384 5B

MANNED SPACECRAFT

Apollo Experience Report, Potable Water System, W73-11202 5F

MANUFACTURED PRODUCTS

Assessing the Water Pollution Potential of Manufactured Products, W73-11334 5B

MANUKAU (NEW ZEALAND)

Urban Hydrology for the Period Up to December 1971, W73-11698 4C

MARINE AEROSOLS

Some Aspects of the Geochemistry of Marine Aerosols, W73-11372 2K

MARINE ALGAE

Carbon Dioxide Dynamics: A Record of Organic Carbon Production, Respiration, and Calcification in the Eniwetok Reef Flat Community, W73-11488 5A

Pesticide Degradation by Marine Algae, W73-11601 5B

MARINE ANIMALS

A Continuous-Flow Apparatus for Assessing the Toxicity of Substances to Marine Animals, W73-11169 5C

Arsenic in the Lipid Extracts of Marine Invertebrates, W73-11189 5C

Mercury in the Marine Environment: Concentration in Sea Water and in a Pelagic Food Chain, W73-11300 5C

Cycling of Elements of Estuaries, W73-11645 5B

MARINE BIOLOGY

Factors Controlling Marine Ecosystems, W73-11380 5C

MARINE ECOSYSTEMS

Factors Controlling Marine Ecosystems, W73-11380 5C

MARINE FISH

Sea Fish Contamination With Mercury (Contamination des poissons de mer par le mercure), W73-11289 5C

DDT, DDE, and Polychlorinated Biphenyls in Biota From the Gulf of Mexico and Caribbean Sea-1971, W73-11580 5B

MARINE SANITATION SYSTEM

Marine Sanitation System Demonstration, W73-11059 5D

SUBJECT INDEX

MERCURY

MARSHES		MAYFLIES	
Plant Communities of Wet Ground in Northeast Cheshire, England, W73-11552	2L	Biological Effects of Fluctuating Water Levels in the Snake River, Grand Teton National Park, Wyoming, W73-11594	2E
Applications of Multispectral Remote Sensing Techniques to Hydrobiological Investigations In Everglades National Park, W73-11553	7B		
MASS SPECTRA		MEASUREMENT	
Mass Spectrometric Identification of Some bis-2,4-Dinitrophenylhydrazones, W73-11487	5A	The U.C.S. Grain-Size Comparator Disc, *W73-11395	7B
MASS SPECTROMETRY		Aesthetic Preference for Water Resource Projects: An Application of Q Methodology, W73-11684	6B
Mass Spectrometric Identification of Some bis-2,4-Dinitrophenylhydrazones, W73-11487	5A		
MASS TRANSFER		MEASUREMENTS	
Reactor Model Parameters - Two-Phase Reactor Design Tubular Reactors, W73-11138	5F	Measurement of Exchangeable Inorganic Phosphate in Lake Sediments, W73-11596	5A
MASSACHUSETTS		BOD: Determining the Necessary Dilution Technique, W73-11661	5A
The Development and Demonstration of an Underwater Oil Harvesting Technique, W73-11063	5G		
MATERIALS		MEAT-PACKING WASTES	
A Literature Survey—Performance of Exceptional Metals in Corrosive Environments, W73-11479	8G	National Meat-Packaging Waste Management Research and Development Program, W73-11440	5D
MATERIALS TESTING			
Procedure Improved for Determining Corrosion Rate by Weight Loss, W73-11478	8G	MECHANICAL CLEAN UP	
A Model for Rain Erosion of Homogeneous Materials, W73-11560	8G	The Development and Demonstration of an Underwater Oil Harvesting Technique, W73-11063	5G
MATHEMATICAL MODELS			
Reactor Model Parameters - Two-Phase Reactor Design Tubular Reactors, W73-11138	5F	MEDITERRANEAN SEA	
Membrane Fouling in Electrodialysis: A Model and Experiments, W73-11163	3A	Some Problems in the Geochemistry of Molybdenum in the Mediterranean Sea (Nekotorye voprosy geokhimii molibdena v Sredizemnom more), W73-11410	2K
Mathematical Methods in the Theory and Practice of Mountain Streamflow Computation and Forecasting (Matematicheskiye metody v teorii i praktike raschetov i prognozov stoka gornykh rek). W73-11406	4A	MEKONG RIVER BASIN	
A Mathematical Model to Aid Management of Outflow from the Okavango Swamp, Botswana, W73-11543	6A	Studies on Schistosomiasis in Mekong Basin: II. Malacological Investigations on Human Schistosomes from Laos, W73-11633	5C
MATHEMATICAL STUDIES			
Mathematical Methods in the Theory and Practice of Mountain Streamflow Computation and Forecasting (Matematicheskiye metody v teorii i praktike raschetov i prognozov stoka gornykh rek). W73-11406	4A	MELTING	
BOD: Determining the Necessary Dilution Technique, W73-11661	5A	Drainings of Ice-Dammed Summit Lake, British Columbia, W73-11547	2E
MATUPI HARBOR			
Volcanic Exhalations and Metal Enrichments at Matupi Harbor, New Britain, T.P.N.G., W73-11292	5B	MEMBRANE FOULING	
		Membrane Fouling in Electrodialysis: A Model and Experiments, W73-11163	3A
		MEMBRANE PROCESSES	
		The Mechanism of Formation of 'Skinned' Type Membranes and Their Characterization, W73-11153	3A
		Research on Piezodialysis, Third Report, W73-11154	3A
		A Neutron Spectroscopic Study of the Diffusive Kinetics and Interactions of Water in Dense Layer Desalination Membranes, W73-11165	3A
		MEMBRANES	
		The Mechanism of Formation of 'Skinned' Type Membranes and Their Characterization, W73-11153	3A
		Investigation of Polybenzimidazole Hollow Fiber Reverse Osmosis Desalination Membranes, W73-11157	3A
		RESEARCH ON REVERSE OSMOSIS MEMBRANES	
		Research on Reverse Osmosis Membranes for Purification of Wash Water at Sterilization Temperature (165°F), W73-11159	3A
		Ion Transport Through Layered Ion Exchange Membranes, W73-11160	3A
		Investigation of Phase and State Relations in Complex Lipid Systems, W73-11161	3A
		A Study of Vapor Phase Polymerization and Crosslinking to Prepare Reverse Osmosis Membranes, W73-11162	3A
		Membrane Fouling in Electrodialysis: A Model and Experiments, W73-11163	3A
		Apparatus for Use in an Improved Electro-Dialysis Process, W73-11230	3A
		MENARD PRESSUREMETER	
		Expansion of Cylindrical Probes in Cohesive Soils, W73-11520	8D
		MENIDIA MENIDIA	
		Copper Induced Lesions in Estuarine Teleosts, W73-11616	5C
		MERCENARY MERCENARIA	
		Residues of Chlorinated Hydrocarbon Pesticides in the Northern Quahog (Hard-Shell Clam), Mercenaria mercenaria-1968 and 1969, W73-11579	5C
		MERCURY	
		Determination of Mercury Contents in Diverse Samples of Fish and Other Biological Materials by Neutron Activation Analysis, (Neutronaktivierungsanalytische Bestimmungen von Quecksilbergehalten in Diversen Fischproben und Anderen Biologischen Materialien), W73-11123	5A
		Mercury Accumulation by Myriophyllum Spicatum L., W73-11168	5C
		Removal of Mercury from Aqueous Solutions by Nitrogen-Containing Chemically Modified Cotton, W73-11174	5D
		Phenylmercuric Acetate: Metabolic Conversion by Microorganisms, W73-11187	5B
		Transfer of Metallic Mercury into the Foetus, W73-11274	5B
		Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish, W73-11279	5B
		Volatilization of Mercuric Chloride by Mercury-Resistant Plasmid-Bearing Strains of Escherichia coli, Staphylococcus aureus, and Pseudomonas aeruginosa, W73-11286	5B
		Cell Systems Keep Mercury From Atmosphere, W73-11287	5G
		Chlorine Makers Clutch at Last Drops of Mercury, W73-11288	5D

SUBJECT INDEX

MERCURY

Sea Fish Contamination With Mercury (Contamination des poissons de mer par le mercure), W73-11289	5C	METABOLISM	Metabolism of Tritiated Water in the Dairy Cow, W73-11186	5B	A Literature Survey--Performance of Exceptional Metals in Corrosive Environments, W73-11479	8G	
Distribution of Dissolved Mercury in the Irish Sea, W73-11293	5B	Certain Biological Effects of Lead Upon the Animal Organism, W73-11307	5C	METEOROLOGICAL DATA	Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering, W73-11631	5A	
The Determination of Small Amounts of Mercury in Organic Matter. W73-11296	5A	METAL COMPLEXES	X-Ray Photoelectron Spectroscopy of Metals in Amino Acid Complexes and Proteins, (Rontgen-Photoelektron-Spektroskopie von Metallen in Aminosäurekomplexen und Proteinen), W73-11121	5A	Precomputation of a Spring-Flood Hydrograph Based on Hydrometeorological Data (Predvychisleniye gidrografa vesennego polovod'ya po gidrometeorologicheskim dannym), W73-11689	2E	
Determination of Trace Mercury in Soil and Rock Media, W73-11297	5A	METAL FINISHING WASTES	Curtailing Pollution from Metal Finishing, W73-11283	5D	METEOROLOGY	The Impact of Weather Modification on U.S. Planning for the Rio Colorado and Rio Grande, W73-11505	3B
Mercury in the Marine Environment: Concentration in Sea Water and in a Pelagic Food Chain, W73-11300	5C	METAL IONS	Cation Exchange Separation of Metal Ions With Potassium Chloride-Chelating Agent-Organic Solvent Medium, W73-11311	5A	METHODOLOGY	Application of Radiochemical Methods in Environmental Research, (Anwendung Radiochemischer Methoden in der Umweltforschung), W73-11125	5A
The Case Against Mercury, W73-11303	5C	METAL PIPES	External Corrosion of Buried Ferrous Pipelines/I, W73-11467	8G	Behavior of Groundwater Flow Subject to Time-Varying Recharge, W73-11142	2F	
Incidence of Mercury in Illinois Pheasants, W73-11305	5A	METALLURGY	Environment, W73-11183	5C	Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management, W73-11150	5G	
Dithizone Procedure for Mercury Analysis, W73-11306	5A	METALS	Precision and Detection Limits of Cadmium, Manganese, Cobalt, and Nickel in Sulfides by Electron Microprobe Analysis, W73-11178	5A	An Environmental Evaluation System for Water Resource Planning, W73-11151	6A	
Mercury--A Case Study of Marine Pollution, W73-11375	5B	Application of Regression Analysis to the Study of Background Variations in Trace Metal Content of Stream Sediments, W73-11179	5A	Determination of Carbohydrate in Lake Sediment by a Modified Phenol-Sulfuric Acid Method, W73-11482	5A		
A Few Coastal Pollution Problems in Japan, W73-11376	5C	Environment, W73-11183	5C	Spectrophotometric Method for Determination of Ozone in Aqueous Solutions, W73-11495	5A		
Man's Role in the Major Sedimentary Cycle, W73-11382	5B	Lithium in Surficial Materials of the Continuous United States and Partial Data on Cadmium, W73-11268	5B	Removal of Oil From Water Surfaces By Sorption on Unstructured Fibers, W73-11586	5G		
Total Mercury and Methylmercury Content of the American Eel (Anguilla rostrata), W73-11576	6C	Diurnal Variation of Aerosol Trace Element Concentrations in Livermore, California, W73-11277	5B	Measurement of Exchangeable Inorganic Phosphate in Lake Sediments, W73-11596	5A		
Mercury, DDT, and PCB in Harbour Seals (Phoca vitulina) From the Bay of Fundy and Gulf of Maine, W73-11577	5C	Areawide Trace Metal Concentrations Measured by Multielement Neutron Activation Analysis - A One Day Study in Northwest Indiana, W73-11278	5B	A Colorimetric Technique Suggested for Chemical Oxygen Demand Determination, W73-11599	5A		
Mercury in Public Sewer Systems, W73-11585	5D	Water Analysis, W73-11285	2K	Copper Determination in Water by Standard Addition Potentiometry, W73-11605	5A		
Mercury in Harbour Porpoises (Phocoena phocoena) From the Bay of Fundy Region, W73-11588	5C	The Use of Atomic Absorption for Analysis of Natural Waters, W73-11291	5A	Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection, W73-11606	5A		
Temperature Effects on Mercury Accumulation, Toxicity, and Metabolic Rate in Rainbow Trout (Salmo gairdneri), W73-11655	5C	Atomic Absorption Spectrophotometry as a Tool for the Water Chemist, W73-11294	5A	Improved Method for Characterizing Environmental Hydrocarbons by Gas Chromatography, W73-11607	5A		
Liquid-Liquid Extraction of Cadmium With High-Molecular-Weight Amines From Iodide Solutions, W73-11664	5A	Atomic Absorption Spectrophotometry in the Field of Marine Research, W73-11298	5A	2,4,6-Triphenylpyrylium Chloride. A New Organic Analytical Reagent for the Determination of Certain Anions, W73-11623	5A		
MERCURY POLLUTION		Cation Exchange Separation of Metal Ions With Potassium Chloride-Chelating Agent-Organic Solvent Medium, W73-11311	5A	A Quantitative, Semiroutine Method for Determining Algal and Sedimentary Chlorophyll Derivatives, W73-11637	5A		
Distribution of Dissolved Mercury in the Irish Sea, W73-11293	5B						
Mercury in the Marine Environment: Concentration in Sea Water and in a Pelagic Food Chain, W73-11300	5C						
METABOLIC RATES							
Temperature Effects on Mercury Accumulation, Toxicity, and Metabolic Rate in Rainbow Trout (Salmo gairdneri), W73-11655	5C						

SUBJECT INDEX

MODEL STUDIES

2,3-Dihydroxynaphthalene as Indicator for the Complexometric Titration of Iron (III) with EDTA,	W73-11641	5A	MILLECOQUINS RIVER (MICHIGAN)	Investigations into the Occurrence of Coliform Organisms from Pristine Streams,	W73-11428	5B	MINING WASTES	The Lead Industry as a Source of Trace Metals in the Environment,	W73-11269	5B
A Centrifuge Method for Determining Live Weights of Aquatic Insect Larvae, with a Note on Weight Loss in Preservative,	W73-11647	5A	MILWAUKEE METROPOLITAN REGION	Community Improvements and Service Costs,	W73-11255	3D	MINNEAPOLIS-ST. PAUL	MSB Computerized Combined Sewer Control System,	W73-11673	5G
Sampling Procedures and Problems in Determining Pesticide Residues in the Hydrologic Environment,	W73-11660	5A	MINAMATA DISEASE	A Few Coastal Pollution Problems in Japan,	W73-11376	5C	MINNESOTA	An Economic Analysis of Flood Damage Reduction Alternatives in the Minnesota River Basin,	W73-11055	6F
BOD: Determining the Necessary Dilution Technique,	W73-11661	5A	MINE DRAINAGE	Evaluation of Pollution Abatement Procedures	Moraine State Park,	W73-11062	5G	MINNESOTA RIVER BASIN	An Economic Analysis of Flood Damage Reduction Alternatives in the Minnesota River Basin,	W73-11055
Polarographic Method for Nitrate and Dissolved Oxygen Analyses,	W73-11662	5A								
Geonatural Resource Planning, Proposed Guidelines for a Detailed Geonatural Resource Inventory and Analysis Required to Undertake a Comprehensive Planning and Development for Albany/Dougherty County, Georgia,	W73-11672	7A					MISCIBLE DISPLACEMENT	Dispersion and Miscible Displacement,	W73-11167	3A
METHYLATION	The Case Against Mercury,	W73-11303	5C	Leachate Quality from Acidic Mine Spoil Fertilized with Liquid Digested Sewage Sludge,	W73-11680	5G	MISSOURI	The Lead Industry as a Source of Trace Metals in the Environment,	W73-11269	5B
METHYLMERCURY	Total Mercury and Methylmercury Content of the American Eel (<i>Anguilla rostrata</i>),	W73-11576	6C	MINERAL INDUSTRY	North Atlantic Regional Water Resources Study : Appendix H, Minerals.	W73-11107	3D	An Investigation of Environmental Pollution by Lead and Other Heavy Metals from Industrial Development in Southeastern Missouri,	W73-11270	5B
MEXICO	Nuclear Dual Purpose Plants in Regional Development,	W73-11496	3A							
MICHIGAN	A Study of the Flint River, Michigan, as it Relates to Low-Flow Augmentation,	W73-11207	5G	MINERAL INDUSTRY	Mineral Industry Vs. Ecology.	W73-11185	5G	Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri,	W73-11271	5C
	Major and Trace Element Loading of Central Michigan Lakes,	W73-11427	5B	MINERAL RESOURCES	North Atlantic Regional Water Resources Study : Appendix H, Minerals.	W73-11107	3D	MITES	Biological Effects of Fluctuating Water Levels in the Snake River, Grand Teton National Park, Wyoming,	W73-11594
MICROBIAL DEGRADATION	Biological Oxidation of the Hydrocarbons in Aqueous Phase,	W73-11132	5B	MINERAL SPRINGS	Distribution and Composition of Mineral Water in the Tuva Autonomous Republic (Zakonomernosti rasprostranieniya i sostav podzemnykh mineral'nykh vod Tuvy),	W73-11412	2F			
MICROORGANISMS	Phenylmercur Acetate: Metabolic Conversion by Microorganisms,	W73-11187	5B	MINERAL WATER	Distribution and Composition of Mineral Water in the Tuva Autonomous Republic (Zakonomernosti rasprostranieniya i sostav podzemnykh mineral'nykh vod Tuvy),	W73-11412	2F	MIXING	Dispersion and Miscible Displacement,	W73-11167
	Water Purification With Porous Abrasives,	W73-11228	5D	MINERALOGY	North Atlantic Regional Water Resources Study : Appendix H, Minerals.	W73-11107	3D			
MICROSCALE VACUUM COLLECTOR	A Simple Microscale Vacuum Collector for the Elution of Closely Situated Spots from Thin-Layer Chromatograms,	W73-11657	5A		Adsorption Characteristics of Opaline Clays From the Eocene of Georgia,	W73-11536	2G	RESEARCH	Research and the Problems of Two Seas,	W73-11350
MICROSTRAINING	Microstraining Removes Algae and Cuts Filter Back-Washing,	W73-11450	5F	MINING	Environmental Contamination by Lead from a Mine and Smelter,	W73-11267	5C	MIXING WASTES	Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri,	W73-11271
	60-MGD Microstraining Plant Meets Denver's Growing Needs,	W73-11667	5F		The Lead Industry as a Source of Trace Metals in the Environment,	W73-11269	5B			
MILL EFFLUENTS	A Control System for Mill Effluent Disposal,	W73-11312	5G	MINING WASTES	An Investigation of Environmental Pollution by Lead and Other Heavy Metals from Industrial Development in Southeastern Missouri,	W73-11270	5B	MOBILE	Mobile Area Water Transportation Study of Mobile, Baldwin and Escambia Counties, Alabama.	W73-11260
							MODEL STUDIES	Effects of Submerged Sills in the St. Clair River,	W73-11089	8B
								Use of Physical Methods to Expand Soil Survey Interpretations of Soil Drainage Conditions,	W73-11210	2G

SUBJECT INDEX

MODEL STUDIES

Nonlinear Parameter Estimation in Water Quality Modeling, W73-11361	5B	MORAINE STATE PARK (PENN) Evaluation of Pollution Abatement Procedures Moraine State Park, W73-11062	5G	MUNICIPAL WASTES Assessing the Water Pollution Potential of Manufactured Products, W73-11334	5B
Chemical Cycles with Energy Circuit Models, W73-11381	2A	MORPHOLOGICAL VARIABILITY The Origin and Domestication of Sorghum Bicolor, W73-11561	3F	Apparatus for Separating Pollutants and Obtaining Separate Liquids and Solids, W73-11359	5D
Combined Effect of Thermal and Organic Pollution on Oxygen Sag Curve, W73-11423	5C	MORPHOLOGY Investigation of Polybenzimidazole Hollow Fiber Reverse Osmosis Desalination Membranes, W73-11157	3A	Mercury in Public Sewer Systems, W73-11585	5D
Reservoir Bank Storage, W73-11542	2H	MORTAR Cement Mortar Lining of 20-Ft Diameter Steel Pipe, W73-11522	8F	MUSCLE Total Mercury and Methylmercury Content of the American Eel (<i>Anguilla rostrata</i>), W73-11576	6C
Cycling of Elements of Estuaries, W73-11645	5B	MOSQUITO CONTROL The Effects of Ditching on the Mosquito Populations in Some Sections of <i>Juncus</i> Salt Marsh in Carteret County, North Carolina, W73-11431	4A	NATURAL RESOURCES Unsupervised Spatial Clustering with Spectral Discrimination, W73-11116	7C
MOISTURE CONTENT		MOSSES Lead Accumulation Within Nuclei of Moss Leaf Cells, W73-11276	5E	Geonatural Resource Planning, Proposed Guidelines for a Detailed Geonatural Resource Inventory and Analysis Required to Undertake a Comprehensive Planning and Development for Albany/Dougherty County, Georgia, W73-11627	7A
Moisture Transfer and Frost Heave in Loams, W73-11193	2G	MOUNTAINS Inflow to Rivers in the Pamirs (Pitaniye rek Pamira), W73-11096	2C	NATURAL WATERS Copper Determination in Water by Standard Addition Potentiometry, W73-11605	5A
MOISTURE STRESS		INVESTIGATION OF SEASONAL VARIABILITY OF RUNOFF ON RIVERS IN THE ALTAI AND SAYAN MOUNTAIN SYSTEMS (Issledovaniye vnutrigodovoy neravnomennosti stoka rek Altaya i Sayan), W73-11101	2E	NAVIER-STOKES EQUATIONS Finite Element Solution for General Fluid Motion, W73-11091	8B
The Response of Native Montana Grasses to Soil Water Stress, W73-11429	2I	MATHEMATICAL METHODS IN THE THEORY AND PRACTICE OF MOUNTAIN STREAMFLOW COMPUTATION AND FORECASTING (Matematicheskiye metody v teorii i praktike raschetov i prognozov stoka gornykh rek), W73-11406	4A	NAVIGATION Effects of Submerged Sills in the St. Clair River, W73-11089	8B
MOISTURE UPTAKE		MULTIBAND PHOTOGRAPHY Aerial Surveillance Spill Prevention System, W73-11326	5B	A Case History of Santa Cruz Harbor, California, W73-11092	8B
Adsorption Characteristics of Opaline Clays From the Eocene of Georgia, W73-11536	2G	MULTIELEMENTAL ANALYSIS Multi-Element Neutron Activation Analysis of Sediment Using a Californium-252 Source, W73-11644	5A	Mobile Area Water Transportation Study of Mobile, Baldwin and Escambia Counties, Alabama. W73-11260	8A
MOLLUSCICIDES		MULTIPLE PURPOSE Linear Programming use for Evaluating Water Resources and Cost and Benefit Allocation, W73-11683	6A	NEBRASKA Groundwater Levels in Nebraska, 1972, W73-11120	4B
A Study of a Small Tropical Lake Treated With the Molluscicide Frescon, W73-11614	5C	MULTIPLE PURPOSE RESERVOIRS Iterative Simulation Algorithm in Reservoir Systems Operation, W73-11139	4A	Influence of Agricultural Practices on Water Quality in Nebraska: A Survey of Streams, Groundwater, and Precipitation, W73-11696	5B
MOLYBDENUM		MULTISPECTRAL IMAGERY Applications of Multispectral Remote Sensing Techniques to Hydrobiological Investigations In Everglades National Park, W73-11553	7B	NEPAL Investigation on Erodibility and Water Stable Aggregates of Certain Soils of Eastern Nepal, W73-11272	2J
Some Problems in the Geochemistry of Molybdenum in the Mediterranean Sea (Nekotorye voprosy geokhimii molibdена v Sredizemnom more), W73-11410	2K	MUMMICHOGS Influence of Lead and Other Metals on Fish Delta-Aminolevulinate Dehydrase Activity, W73-11646	5A	Hydrology and Water Resources Development in Nepal, W73-11401	4A
MONITOR STREAMS		NEUTRON ACTIVATION ANALYSIS Neutron Activation Analysis of Bottom Sediments, W73-11067	5A		
Use of Fire Streams to Control Floating Oil, W73-11435	5G				
MONITORING					
Liquid Sampling, W73-11235	7B				
ADSORPTION OF CHLORINATED HYDROCARBONS FROM SEAWATER BY A CROSSLINKED POLYMER, W73-11443	5A				
CARBON DIOXIDE DYNAMICS: A RECORD OF ORGANIC CARBON PRODUCTION, RESPIRATION, AND CALCIFICATION IN THE ENIWETOK REEF FLAT COMMUNITY, W73-11488	5A				
ECOLOGICAL MONITORING OF TWO BEACH NOURISHMENT PROJECTS IN BROWARD COUNTY, FLORIDA, W73-11528	2J				
MONOMOLECULAR FILMS					
Impact of Natural and Man-Made Surface Films on the Properties of the Air-Sea Interface, W73-11371	5B				
MONTANA					
Limnology of Yellowtail Reservoir and the Big Horn River, W73-11331	5C				
MONTE SANO BAYOU (LOUISIANA)					
Study for Improvement of Monte Sano Bayou from Airline Highway to Mississippi River East Branch Rouge Parish, Louisiana. W73-11682	8A				

SUBJECT INDEX

NITROGEN CYCLE

Determination of Mercury Contents in Diverse Samples of Fish and Other Biological Materials by Neutron Activation Analysis, (Neutronenaktivierungsanalytische Bestimmungen von Quecksilbergehalten in Diversen Fischproben und Anderen Biologischen Materialien), W73-11123	5A	Emerging Water Supply Technology. W73-11246	3D	Oxygen Deficient Conditions and Nitrate Reduction in the Eastern Tropical North Pacific Ocean, W73-11589	5A
Arealwide Trace Metal Concentrations Measured by Multiclement Neutron Activation Analysis - A One Day Study in Northwest Indiana, W73-11278	5B	A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. V, Jamaica Bay Rainstorms, W73-11351	5B	Quantitative Infrared Spectrophotometry of Organic Nitrate Esters, W73-11600	5A
Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material, W73-11339	5A	River Systems Transition Function and Operation Study, W73-11364	4A	Polarographic Method for Nitrate and Dissolved Oxygen Analyses, W73-11662	5A
Multi-Element Neutron Activation Analysis of Sediment Using a Californium-252 Source, W73-11644	5A	NEW YORK BIGHT		NITROLIOTRIACETIC ACID	
NEUTRON SPECTROSCOPY		Hydrographic Study of the Shelf and Slope Waters of New York Bight, W73-11110	2E	Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material, W73-11339	5A
A Neutron Spectroscopic Study of the Diffusive Kinetics and Interactions of Water in Dense Layer Desalination Membranes, W73-11165	3A	System Study for Surveillance of Ocean Dumping Operations. W73-11573	5B	NITRITES	
NEVADA		Smithsonian Advisory Committee Report on Studies of the Effects of Waste Disposal in the New York Bight, W73-11642	5C	Nutrient Inversions in the Southeastern Tropical Pacific Ocean, W73-11587	2L
Freeze-Free (32 F) Seasons of the Major Basins and Plateaus of Nevada, W73-11218	7C	NEW YORK CITY		Oxygen Deficient Conditions and Nitrate Reduction in the Eastern Tropical North Pacific Ocean, W73-11589	5A
Bathymetric Reconnaissance of Wild Horse Reservoir, Elko County, Nevada, W73-11219	7C	Emerging Water Supply Technology. W73-11246	3D	NITROGEN	
Bathymetric Reconnaissance of Weber Reservoir, Mineral County, Nevada, W73-11220	7C	NEW ZEALAND		Phosphorus Removal, A Bibliography, Volume 1, W73-11319	5D
Hydrology of Truckee Meadows, Nevada, W73-11430	4B	Urban Hydrology for the Period Up to December 1971. W73-11698	4C	Phosphorus Removal, A Bibliography, Volume 2, W73-11320	5D
NEW ENGLAND		NEWSPRINT		Study of the Respiration and the Nitrogen and Phosphorus Excretion of Zooplanktonic Populations of the Mauritanian Upwelling, (March-April 1972). (Etude de la Respiration et de L'Excretion d'Azote et de Phosphore des Populations Zooplanctoniques de L'Upwelling Mauritanien (Mars-Avril 1972), W73-11603	5B
North Atlantic Regional Water Resources Study : Appendix H, Minerals. W73-11107	3D	Tertiary Filtering Arrangement, W73-11241	5D	Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection, W73-11606	5A
NEW HAMPSHIRE		NICHES		Nitrogen and Phosphorus Uptake by Chlorella pyrenoidosa in Sewage Treatment Processes, W73-11617	5B
The Use of Modern Chromium Accumulations to Determine Estuarine Sedimentation Rates, W73-11392	2L	Partitioning of a Brackish Water Habitat by Copepod Species, W73-11130	5A	The Role of Nitrogen in the Aquatic Environment, W73-11640	5C
Linear Programming use for Evaluating Water Resources and Cost and Benefit Allocation, W73-11683	6A	NICKEL		NITROGEN BUDGET	
NEW JERSEY		Volumetric Determination of Nickel by High Frequency Impedimetry, W73-11127	5A	Possibility of Reducing Nitrogen in Drainage Water By On Farm-Practices, (Bio-Engineering Aspects of Agricultural Drainage, San Joaquin Valley, California). W73-11324	5B
Effects of Land Use and Retention Practices on Sediment Yields in the Stony Brook Basin, New Jersey, W73-11113	4C	NITROGEN COMPOUNDS		W73-11324	5B
Water Supply Improvements Feature New Coagulator, W73-11315	5F	Biological Removal of Carbon and Nitrogen Compounds from Coke Plant Wastes, W73-11328	5D	NITROGEN ESTERS	
NEW YORK		NITRATE ESTERS		Quantitative Infrared Spectrophotometry of Organic Nitrate Esters, W73-11600	5A
Characteristics and Environmental Quality of Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York, W73-11108	2K	NITRATES		NITROGEN COMPOUNDS	
Survey of Water Quality and Sediments in Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York (Appendix to Technical Report No. 14), W73-11109	2K	Possibility of Reducing Nitrogen in Drainage Water By On Farm-Practices, (Bio-Engineering Aspects of Agricultural Drainage, San Joaquin Valley, California). W73-11324	5B	Quantitative Infrared Spectrophotometry of Organic Nitrate Esters, W73-11600	5A
Scope of Public Water Supply Needs. W73-11245	6D	The Seasonal Cycle of Vitamin B12 in the Strait of Georgia, British Columbia, W73-11578	2L	NITROGEN CYCLE	
		Preliminary Report, (RV Thomas G. Thompson Cruise 66), W73-11583	5A	Nitrous Oxide in Air and Sea Water over the Atlantic Ocean, W73-11370	5B
		Nutrient Inversions in the Southeastern Tropical Pacific Ocean, W73-11587	2L	The Role of Nitrogen in the Aquatic Environment, W73-11640	5C

SUBJECT INDEX

NITROGEN-FIXING NODULES

NITROGEN-FIXING NODULES
 The Effects of Water Stress on Nitrogen-fixing Root Nodules: II. Effects of the Fine Structure of Detached Soybean Nodules, W73-11415 3F

The Effects of Water Stress on Nitrogen-fixing Root Nodules: III. Effects of Osmotically Applied Stress, W73-11416 3F

NITROUS OXIDE
 Nitrous Oxide in Air and Sea Water over the Atlantic Ocean, W73-11370 5B

NON-AQUEOUS CHLORINATION
 Oxidation of Pyrites in Chlorinated Solvents, W73-11068 5D

NON-STRUCTURAL ALTERNATIVES
 An Economic Analysis of Flood Damage Reduction Alternatives in the Minnesota River Basin, W73-11055 6F

NONELECTROLYTES
 Salt and Nonelectrolyte Interactions in Water, W73-11166 1B

NORTH ATLANTIC
 Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish, W73-11279 5B

NORTH CAROLINA
 Parasite Copepods of Some Freshwater Fishes from North Carolina, W73-11143 2I

An Evaluation of the Utility of Available Remote Sensor Returns for a Study of Slope Failure Phenomena, W73-11216 7B

The Effects of Ditching on the Mosquito Populations in Some Sections of Juncus Salt Marsh in Carteret County, North Carolina, W73-11431 4A

NORTH DAKOTA
 Water Quality Investigations: Souris River Basin, North Dakota, 1969, W73-11115 5B

Ground-water Basic Data of Cavalier and Pembina Counties, W73-11397 4B

NOZZLES
 Use of Fire Streams to Control Floating Oil, W73-11435 5G

Removal of Oil From Under Piers, W73-11438 5G

NUCLEAR POWERPLANTS
 Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington, W73-11204 5B

NUCLEATION
 High-Temperature Contact Nucleation of Supercooled Water by Organic Chemicals and Appendix of Compounds Tested, W73-11699 3B

NUMERICAL ANALYSIS
 Finite Element Solution for General Fluid Motion, W73-11091 8B

Numerical Techniques Applied to Particle Deposition During Slot Flow, W73-11697 2J

NUTRIENT INVERSION
 Nutrient Inversions in the Southeastern Tropical Pacific Ocean, W73-11587 2L

NUTRIENT REMOVAL
 Effect of Soil, Cover, Slope, and Rainfall Factors on Soil and Phosphorus Movement Under Simulated Rainfall Conditions, W73-11208 5B

Phosphorus Removal, A Bibliography, Volume I, W73-11319 5D

Phosphorus Removal, A Bibliography, Volume 2, W73-11320 5D

Nitrogen and Phosphorus Uptake by Chlorella pyrenoidosa in Sewage Treatment Processes, W73-11617 5B

NUTRIENT REQUIREMENTS
 Plant Analysis for Nutrient Assay of Natural Waters, W73-11057 5C

NUTRIENTS
 An In Situ Evaluation of Nutrient Effects in Lakes, W73-11070 5C

Nutrient Ratio Variation in Reservoir Sediments, W73-11591 5B

Panktonic Changes Following the Restoration of Lake Trumen, Sweden, W73-11639 5G

The Role of Nitrogen in the Aquatic Environment, W73-11640 5C

OBSERVATION BOREHOLES
 Observation Boreholes--Construction and Use: Final Report of Research Panel, No. 9, W73-11466 8A

OBSERVATION WELLS
 Observation Boreholes--Construction and Use: Final Report of Research Panel, No. 9, W73-11466 8A

OCEAN CIRCULATION
 Physical Models of Large Scale Ocean Circulation, W73-11368 2E

OCEAN CURRENTS
 Physical Models of Large Scale Ocean Circulation, W73-11368 2E

OCEAN DUMPING OPERATIONS
 System Study for Surveillance of Ocean Dumping Operations, W73-11573 5B

OCEAN WAVES
 Spectra of Turbulent Fluctuations Over Ocean Waves, W73-11087 2B

The Use of Ocean Tide Records to Detect Motions Premonitory to a Tectonic Event in the Long Beach, California Area, W73-11214 7B

OCEANOGRAPHY

Hydrographic Study of the Shelf and Slope Waters of New York Bight, W73-11110 2E

OCEANS

Spectra of Turbulent Fluctuations Over Ocean Waves, W73-11087 2B

Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering, W73-11631 5A

ODOR

Taste and Odor Control in Water, W73-11318 5F

Taste and Odor Control - Chemicals and Methods, W73-11421 5F

Response of Lobsters Homarus americanus to Odor Solution in The Presence of Bleached Kraft Mill Effluent, W73-11619 5C

ODOR CONTROL

Steam Stripping Odorous Substances from Kraft Effluent Streams (SEKOR), W73-11060 5D

OHIO

A Water System Designed to Attract Industry, W73-11317 5F

Ultra High Rate Filtration of Activated Sludge Plant Effluent, W73-11337 5D

OHIO RIVER

Supplementation of Missing Values in Water Quality Data, W73-11687 5G

OIL

Petroleum Hydrocarbons and Fatty Acids in Wastewater Effluents, W73-11575 5B

OIL INDUSTRY

Land Spreading, A Conserving and Non-Polluting Method of Disposing of Oily Wastes, W73-11535 5E

OIL POLLUTION

Method of Removing Oil from Water, W73-11225 5G

Vacuum Skimming Apparatus for Removing Liquid Contaminants Floating in Confined Bodies of Water, W73-11232 5G

Skimming Device for use on a Liquid Surface, W73-11233 5D

Removal of Oil From Under Piers, W73-11438 5G

Standard Dispersant Effectiveness and Toxicity Tests, W73-11442 5A

Oil/Sorbent Harvesting System for Use on Vessels of Opportunity, W73-11445 5G

Dispersed and Particulate Petroleum Residues in the Gulf of St. Lawrence, W73-11612 5B

SUBJECT INDEX

ORGANIC COMPOUNDS

OIL RECOVERY SYSTEMS

The Development and Demonstration of an Underwater Oil Harvesting Technique,
W73-11063 5G

Oil/Sorbent Harvesting System for Use on Vessels of Opportunity,
W73-11445 5G

OIL REMOVAL

Removal of Oil From Water Surfaces By Sorption on Unstructured Fibers,
W73-11586 5G

OIL SEAL

Shore Termination for Oil Spill Booms,
W73-11437 5G

OIL SHALE (COLORADO)

Effects of Chemical Variations in Aquatic Environments: Volume I, Biota and Chemistry of Piceance Creek,
W73-11074 5C

OIL/SORBENT RECOVERY

Oil/Sorbent Harvesting System for Use on Vessels of Opportunity,
W73-11445 5G

OIL SPILL CONTAINMENT BOOM

A Rapidly Deployable Oil Containment Boom for Emergency Harbor Use,
W73-11439 5G

OIL SPILLS

The Development and Demonstration of an Underwater Oil Harvesting Technique,
W73-11063 5G

Development of a Mobile System for Cleaning Oil-Contaminated Beaches,
W73-11064 5G

Development and Preliminary Design of a Sorbent-Oil Recovery System,
W73-11071 5G

Remote Sensing Techniques for Detecting Oil Slicks,
W73-11137 5A

Method of Removing Oil from Water,
W73-11225 5G

Vacuum Skimming Apparatus for Removing Liquid Contaminants Floating in Confined Bodies of Water,
W73-11232 5G

Using Fire Streams With a Self-Propelled Oil Spill Skimmer,
W73-11434 5G

A Small Vacuum Oil Skimming System,
W73-11436 5G

Shore Termination for Oil Spill Booms,
W73-11437 5G

Removal of Oil From Under Piers,
W73-11438 5G

A Rapidly Deployable Oil Containment Boom for Emergency Harbor Use,
W73-11439 5G

Crude Oil Behavior on Arctic Winter Ice,
W73-11539 5B

Removal of Oil From Water Surfaces By Sorption on Unstructured Fibers,
W73-11586 5G

OIL SPOILS

Recovery of Salt Marsh Vegetation From Successive Oil Spillages,
W73-11649 5C

Small-Scale Experiments to Determine the Effects of Crude Oil Films on Gas Exchange Over the Coral Back-Reef at Heron Island,
W73-11650 5C

OIL WASTES

Biological Oxidation of the Hydrocarbons in Aqueous Phase,
W73-11132 5B

De-Oiling of Polluted Waters,
W73-11226 5D

Skimming Device for use on a Liquid Surface,
W73-11233 5D

OIL-WATER INTERFACES

Impact of Natural and Man-Made Surface Films on the Properties of the Air-Sea Interface,
W73-11371 5B

A Small Vacuum Oil Skimming System,
W73-11436 5G

OIL-WATER SEPARATION

Development of a Mobile System for Cleaning Oil-Contaminated Beaches,
W73-11064 5G

OILS

Man's Role in the Major Sedimentary Cycle,
W73-11382 5B

OILY WATER

Impact of Natural and Man-Made Surface Films on the Properties of the Air-Sea Interface,
W73-11371 5B

Improved Method for Characterizing Environmental Hydrocarbons by Gas Chromatography,
W73-11607 5A

Dispersed and Particulate Petroleum Residues in the Gulf of St. Lawrence,
W73-11612 5B

OKAVANGO RIVER (BOTSWANA)

A Mathematical Model to Aid Management of Outflow from the Okavango Swamp, Botswana,
W73-11543 6A

OLEOPHILIC RESINS

De-Oiling of Polluted Waters,
W73-11226 5D

ON-SITE INVESTIGATIONS

An In Situ Evaluation of Nutrient Effects in Lakes,
W73-11070 5C

Application of Regression Analysis to the Study of Background Variations in Trace Metal Content of Stream Sediments,
W73-11179 5A

ONCORHYNCHUS KISUTCH

Identification of the Constituents of Kraft Pulping Effluent That are Toxic to Juvenile Coho Salmon (*Oncorhynchus kisutch*),
W73-11638 5A

ONCORHYNCHUS NERKA

Sublethal Effects of Bleached Kraft Pulp Mill Effluent on Respiration and Circulation in Sockeye Salmon (*Oncorhynchus nerka*),
W73-11615 5C

OPERULATE SNAILS

The Effects of Temperature on Growth and Reproduction of Aquatic Snails,
W73-11444 5C

OPTICAL PROPERTIES

Remote Sensing Techniques for Detecting Oil Slacks,
W73-11137 5A

OPTIMIZATION

Peak Load Pricing Model of an Electric Utility Using Pumped Storage,
W73-11146 6A

Generic Feed Forward Control of Activated Sludge,
W73-11362 5D

Discrete Gradient Optimization of Water Systems,
W73-11365 8B

Optimum Hole Diameter for Water Wells,
W73-11468 8A

OREGON

Computer Simulation of Eutrophication,
W73-11051 5C

Aerobic Secondary Treatment of Plywood Glue Wastes,
W73-11065 5D

Phosphorus Release from Lake Sediments,
W73-11072 5C

Groundwater Data in the Corvallis-Albany Area, Central Willamette Valley, Oregon,
W73-11093 4B

Effects of Logging on Growth of Juvenile Coho Salmon,
W73-11433 5C

Effects of Logging on Periphyton in Coastal Streams of Oregon,
W73-11582 5C

ORGANIC COMPOUNDS

Alpha-Al203 as an Adsorbent in Thin-Layer Chromatography,
W73-11128 5A

Phenylmercuric Acetate: Metabolic Conversion by Microorganisms,
W73-11187 5B

Impairment of the Flavor of Fish by Water Pollutants,
W73-11322 5C

Activated Carbon for Water Treatment,
W73-11352 5F

Activated Carbon for Palatable Water: Granular or powdered.
W73-11422 5F

Improved Method for Characterizing Environmental Hydrocarbons by Gas Chromatography,
W73-11607 5A

Gas Chromatograph Peaks Identified On-Line by a New Grating Infrared Spectrophotometer,
W73-11609 5A

SUBJECT INDEX

ORGANIC COMPOUNDS

Improved Double Detection Gas Chromatograph-Mass Spectrometer Interface for the Analysis of Complex Organic Mixtures, W73-11663	5A	OSMOTIC STRESS (PLANTS) The Effects of Water Stress on Nitrogen-fixing Root Nodules: III. Effects of Osmotically Applied Stress, W73-11416	3F	Spectrophotometric Method for Determination of Ozone in Aqueous Solutions, W73-11495	5A
High-Temperature Contact Nucleation of Supercooled Water by Organic Chemicals and Appendix of Compounds Tested, W73-11699	3B	OSWEGO RIVER SYSTEM River Systems Transition Function and Operation Study, W73-11364	4A	Ozone for Supplementary Water Treatment, W73-11677	5F
ORGANIC LOADING		OUTFALLS		Ozonation of Microstrained Secondary Effluent, W73-11678	5D
Organic Loading of Petenwell Reservoir, Wisconsin, W73-11486	5C	Numerical Thermal Plume Model for Vertical Outfalls in Shallow Water, W73-11333	5B	F-32	
ORGANIC MATTER		OVERFLOW		A Solvent Extraction Method for the Determination of Phosphorus-32 in Sea Water, W73-11643	5A
Organic Materials in the Marine Environment and the Associated Metallic Elements, W73-11184	5B	MSB Computerized Combined Sewer Control System, W73-11673	5G	PACIFIC NORTHWEST U.S.	
The Determination of Small Amounts of Mercury in Organic Matter, W73-11296	5A	OVERLAND FLOW		On Large Diversions from the Northwest-Normal and High-Flow Years, W73-11685	6A
On The Age of Stable Organic Matter—Aquatic Humus in Oceanic Waters, W73-11379	5B	Hydraulics of Shallow Flows Over Stable Eroded Sand Surfaces Defined by Area Spectra, W73-11192	2A	PACIFIC OCEAN	
Conditions of Preservation of Chlorophyll, Pheophytin, and Humic Substances in Black Sea Sediments (Usloviya sokhraneniya klorofilla, feofitina i guminovykh veshchestv v otlozhennyakh Chernogo morya), W73-11411	2J	OXIDATION		Nutrient Inversions in the Southeastern Tropical Pacific Ocean, W73-11587	2L
ORGANIC NITROGEN COMPOUNDS		Biological Oxidation of the Hydrocarbons in Aqueous Phase, W73-11132	5B	Oxygen Deficient Conditions and Nitrate Reduction in the Eastern Tropical North Pacific Ocean, W73-11589	5A
Quantitative Infrared Spectrophotometry of Organic Nitrate Esters, W73-11600	5A	Oxidation of Copper (II) Selenide by Thiobacillus Ferrooxidans, W73-11171	5C	Physical-Chemical Oceanographic Data from the North Pacific Ocean and Bering Sea, 1971, W73-11595	5A
Chemical Oxygen Demand of Some Nitrogenous Heterocyclic Compounds, W73-11611	5A	Dyestuff Color Removal by Ionizing Radiation and Chemical Oxidation, W73-11329	5D	PACIFIC SALMON	
ORGANIC POLLUTION		Chemical Oxygen Demand of Some Nitrogenous Heterocyclic Compounds, W73-11611	5A	Development of Dissolved Oxygen Criteria for Freshwater Fish, W73-11327	5C
Combined Effect of Thermal and Organic Pollution on Oxygen Sag Curve, W73-11423	5C	PALEOGEOGRAPHY		PALEOGEOGRAPHY	
ORGANIC SOLVENTS		Occurrence of Salmonella in Oxidation Ditches, W73-11136	5A	Great Glaciations in the History of the Earth (Velikiye oledeneniya v istorii Zemli), W73-11095	2C
Anion Exchange Separations of the Elements Extractable with Tributyl Phosphate. IV. (Anionenaustausch trennungen der mit Tributylphosphat extrahierbaren Elemente. IV), W73-11122	5A	OXYGEN		PALM SPRINGS AREA (CALIF)	
ORGANOOLEPTIC EVALUATION		Oxygen—A Major Element in Drill Pipe Corrosion, W73-11453	8G	Artificial Recharge in the Whitewater River Area, Palm Springs, California, W73-11565	4B
Impairment of the Flavor of Fish by Water Pollutants, W73-11322	5C	OXYGEN REQUIREMENTS		PARASITES	
ORGANOOLEPTIC PROPERTIES		Development of Dissolved Oxygen Criteria for Freshwater Fish, W73-11327	5C	Parasite Copepods of Some Freshwater Fishes from North Carolina, W73-11143	2I
Impairment of the Flavor of Fish by Water Pollutants, W73-11322	5C	The Acceleration of the Hydrogeochemical Cycling of Phosphorus, W73-11385	5B	PARTICLE SIZE	
ORGANOMERCURIALS		OXYGEN SAG CURVE		The U.C.S. Grain-Size Comparator Disc, W73-11395	7B
Volatilization of Mercuric Chloride by Mercury-Resistant Plasmid-Bearing Strains of Escherichia coli, Staphylococcus aureus, and Pseudomonas aeruginosa, W73-11286	5B	Combined Effect of Thermal and Organic Pollution on Oxygen Sag Curve, W73-11423	5C	Falling-Drop Technique for Silt-Clay Sediment Analysis, W73-11558	5A
ORGANOPHOSPHORUS PESTICIDES		OYSTERS		PATENTS	
Clean-Up of Crude Extracts Containing Pesticide Residues by an Aromatic Apparatus Based Upon the Principle of 'Sweep Co-Distillation' (Reinigung Pestiziddruckstange Enthalender Rohextrakte Mit einer Automatisch Arbeitenden Apparatur Nach Dem Prinzip der Kombinierten Spülung und Codestillation (Sweep Codistillation)), W73-11124	5A	Dursban (Trademark) and Diazinon Residues in Biota Following Treatment of Intertidal Plots on Cape Cod - 1967-69, W73-11627	5C	Centrifugal Distillation System, W73-11223	3A
SU-38		OZONE		Process for the Removal of Cyanide from Sewage by Means of Formaldehyde, W73-11224	5D
		Ozonation at Whiting: 26 Years Later, W73-11316	5F	Method of Removing Oil from Water, W73-11225	5G
		The Inference of Atmospheric Ozone Using Satellite Nadir Measurements in the 1042/CM Band, W73-11400	7B	De-Oiling of Polluted Waters, W73-11226	5D
				Method and Apparatus for Detecting the Hardness Level of Water, W73-11227	7B
				Water Purification With Porous Abrasives, W73-11228	5D

SUBJECT INDEX

PESTICIDE TOXICITY

Accelerated Biological-Chemical Wastewater Treatment, W73-11229	5D	Movement of Acarol and Terbicil Pesticides During Displacement Through Columns of Wabasso Fine Sand, W73-11337	5B	PERMIAN PERIOD Upper Permian Glaciomarine Deposits in the Kolyma River Basin (Verkhnepermskiye ledovo-morskiye otlozheniya basseyna istokov r. Kolomy), W73-11103	2J
Apparatus for Use in an Improved Electro-Dialysis Process, W73-11230	3A	Radionuclides in Transport in the Columbia River from Pasco to Vancouver, Washington, W73-11549	5B	PERMSELECTIVE MEMBRANES Research on Piezodialysis, Third Report, W73-11154	3A
Apparatus for Treating Sewage, W73-11231	5D	Measurement of Salt-Wedge Excursion Distance in the Duwamish River Estuary, Seattle, Washington, by Means of the Dissolved-Oxygen Gradient, W73-11564	5B	PERMUTET UNIT Water Supply Improvements Feature New Coagulator, W73-11315	5F
Vacuum Skimming Apparatus for Removing Liquid Contaminants Floating in Confined Bodies of Water, W73-11232	5G	PATHOGENIC FUNGI Application of the Fluorescent Antibody Technique to the Differentiation of Aspergillus Species, Candida Species and Zygomycetes in Paraffin Section of Formalin-Fixed Tissues, W73-11126	5A	PERSONNEL Systems Approach to Training and Licensing of Water Works Personnel in Ontario, W73-11676	5F
Skimming Device for use on a Liquid Surface, W73-11233	5D	PATHOLOGY The Case Against Mercury, W73-11303	5C	PEST CONTROL The Effects of Ditching on the Mosquito Populations in Some Sections of Juncus Salt Marsh in Carteret County, North Carolina, W73-11431	4A
Water Decomposition Apparatus, W73-11234	5F	PEAK DISCHARGE An Investigation of Floods in Hawaii Through September 30, 1972, W73-11404	2E	PESTICIDE RESIDUES Clean-Up of Crude Extracts Containing Pesticide Residues by an Automatic Apparatus Based Upon the Principle of 'Sweep Co-Distillation, (Reinigung Pesticiddruckstange Enthalender Rohextrakte Mit Einer Automatischen Arbeitenden Apparatur Nach Dem Prinzip der Kombinierten Spülund Codestillation (Sweep Codistillation)), W73-11124	5A
Liquid Sampling, W73-11235	7B	PEAK LOADS Peak Load Pricing Model of an Electric Utility Using Pumped Storage, W73-11146	6A	Residues of Chlorinated Hydrocarbon Pesticides in the Northern Quahog (Hard-Shell Clam), Mercenaria mercenaria-1968 and 1969, W73-11579	5C
Softening of Sea Water By Addition of Barium Carbonate and CO ₂ , W73-11236	5F	PEAT Pore Pressure Measurements in Aelotropic Peat, W73-11195	2G	DDT, DDE, and Polychlorinated Biphenyls in Biota From the Gulf of Mexico and Caribbean Sea-1971, W73-11580	5B
Softening of Sea Water by Addition of Barium Carbonate and Mineral Acid, W73-11237	5F	PENNSYLVANIA Evaluation of Pollution Abatement Procedures Moraine State Park, W73-11062	5G	Pesticides in Water, W73-11618	5B
Purification of Waste Water, W73-11238	5D	An Inventory of Suspended Sediment Stations and Type of Data Analysis for Pennsylvania Streams, 1947-70, W73-11083	2J	Dursban (Trademark) and Diazinon Residues in Biota Following Treatment of Intertidal Plots on Cape Cod - 1967-69, W73-11627	5C
Activated Sludge Sewage Treatment Process and System, W73-11239	5D	Fish and Food Organisms in Acid Mine Waters of Pennsylvania, W73-11332	5C	Sampling Procedures and Problems in Determining Pesticide Residues in the Hydrologic Environment, W73-11660	5A
Activated Sludge Process and System, W73-11240	5D	Effects of Roadway and Pond Construction on Sediment Yield Near Harrisburg, Pennsylvania, W73-11700	2J	PESTICIDE TOXICITY Environmental Effects on Toxaphene Toxicity to Selected Fishes and Crustaceans, W73-11323	5C
Tertiary Filtering Arrangement, W73-11241	5D	PENOBSCOT RIVER Macrofaunal Ecology of a Sawdust-Bearing Substrate in the Penobscot River Estuary (Maine), W73-11602	5C	A Study of a Small Tropical Lake Treated With the Molluscicide Frescon, W73-11614	5C
Apparatus for Handling Sewage, W73-11242	5D	PENSACOLA (FLA) Availability of Groundwater for Public-Water Supply in Central and Southern Escambia County, Florida: Interim Report, July 1972, W73-11563	2F	Dursban (Trademark) and Diazinon Residues in Biota Following Treatment of Intertidal Plots on Cape Cod - 1967-69, W73-11627	5C
Waste Water Sampler, W73-11243	5A	PERMEABILITY A Study of Vapor Phase Polymerization and Crosslinking to Prepare Reverse Osmosis Membranes, W73-11162	3A	Effects of Sublethal Concentrations of Sodium Pentachlorophenate on Growth Rate, Food Conversion Efficiency, and Swimming Performance in Underyearling Sockeye Salmon (<i>Oncorhynchus nerka</i>), W73-11656	5C
Reverse Osmosis Water Purifying System with Gradient Barrier Water Storage Container, W73-11356	3A				
Sludge Concentration, W73-11357	5D				
Flash Evaporator Structure, W73-11358	3A				
Apparatus for Separating Pollutants and Obtaining Separate Liquids and Solids, W73-11359	5D				
PATH OF POLLUTANTS					
Phosphorus Losses From Four Agricultural Watersheds on Missouri Valley Loess, W73-11209	5B				
Volatilization of Mercuric Chloride by Mercury-Resistant Plasmid-Bearing Strains of <i>Escherichia coli</i> , <i>Staphylococcus aureus</i> , and <i>Pseudomonas aeruginosa</i> , W73-11286	5B				
Mercury--A Case Study of Marine Pollution, W73-11375	5B				
Geological, Geochemical and Environmental Implications of the Marine Dust Veil, W73-11383	5B				

SUBJECT INDEX

PESTICIDES

PESTICIDES
Movement of Acarol and Terbicil Pesticides During Displacement Through Columns of Wabasso Fine Sand, W73-11537 5B

Handbook of Toxic Chemicals (Second Edition, Revised and Supplemented), W73-11554 5C

Pesticide Degradation by Marine Algae, W73-11601 5B

PETENWELL RESERVOIR

Organic Loading of Petenwell Reservoir, Wisconsin, W73-11486 5C

PETROLEUM FRACTIONS

Simulated Distillation of Narrow, High Boiling Hydrocarbon Fractions, W73-11613 5A

PETROLEUM PRODUCTS

Improved Method for Characterizing Environmental Hydrocarbons by Gas Chromatography, W73-11607 5A

PETROLEUM RESIDUES

Dispersed and Particulate Petroleum Residues in the Gulf of St. Lawrence, W73-11612 5B

PETROLOGY

Upper Permian Glaciomarine Deposits in the Kolyma River Basin (Verkhnepermskiye ledovo-morskiye otlozheniya basseyna istokov r. Kolomy), W73-11103 2J

PH STAT

Low Cost Multichannel Scanning pH-Stat, W73-11492 5A

PHENOL-SULFURIC ACID METHOD

Determination of Carbohydrate in Lake Sediment by a Modified Phenol-Sulfuric Acid Method, W73-11482 5A

PHENOLIC PESTICIDES

Effects of Sublethal Concentrations of Sodium Pentachlorophenate on Growth Rate, Food Conversion Efficiency, and Swimming Performance in Underyearling Sockeye Salmon (*Oncorhynchus nerka*), W73-11636 5C

PHENOLS

Determination of Phenols and Aromatic Amines by Direct Titration with Bromine in Propylene Carbonate, W73-11485 5A

PHEOPHYTIN

Conditions of Preservation of Chlorophyll, Pheophytin, and Humic Substances in Black Sea Sediments (Usloviya sokhranosti khlorofilla, feofitina i guminovykh veshchestv v otlozheniyakh Chernogo morya), W73-11411 2J

PHOCA VITULINA

Mercury, DDT, and PCB in Harbour Seals (*Phoca vitulina*) From the Bay of Fundy and Gulf of Maine, W73-11577 5C

PHOCOENA PHOCOENA

Mercury in Harbour Porpoises (*Phocoena phocoena*) From the Bay of Fundy Region, W73-11588 5C

PHOSPHATES

Phosphate in Interstitial Waters of Anoxic Sediments: Oxidation Effects During Sampling Procedure, W73-11118 5B

Effect of Soil, Cover, Slope, and Rainfall Factors on Soil and Phosphorus Movement Under Simulated Rainfall Conditions, W73-11208 5B

Phosphorus Losses From Four Agricultural Watersheds on Missouri Valley Loess, W73-11209 5B

Accelerated Biological-Chemical Wastewater Treatment, W73-11229 5D

Purification of Waste Water, W73-11238 5D

Phosphorus Removal, A Bibliography, Volume 1, W73-11319 5D

Phosphorus Removal, A Bibliography, Volume 2, W73-11320 5D

Continuous Culture of Rhodotorula rubra: Kinetics of Phosphate-Arsenate Uptake, Inhibition, and Phosphate-Limited Growth, W73-11574 5A

The Seasonal Cycle of Vitamin B12 in the Strait of Georgia, British Columbia, W73-11578 2L

Nutrient Inversions in the Southeastern Tropical Pacific Ocean, W73-11587 2L

Measurement of Exchangeable Inorganic Phosphate in Lake Sediments, W73-11596 5A

PHOSPHORUS

Phosphorus Release from Lake Sediments, W73-11072 5C

Enumeration and Differentiation of Water Bacteria with Phosphorus-32, W73-11133 5A

The Acceleration of the Hydrogeochemical Cycling of Phosphorus, W73-11385 5B

Phosphorus in Waste Water, W73-11592 5D

Study of the Respiration and the Nitrogen and Phosphorus Excretion of Zooplanktonic Populations of the Mauritanian Upwelling, (March-April 1972). (Etude de la Respiration et de l'Excretion d'Azote et de Phosphore des Populations Zooplanctoniques de L'Upwelling Mauritanien (Mars-Avril 1972)), W73-11603 5B

Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection, W73-11606 5A

Nitrogen and Phosphorus Uptake by Chlorella pyrenoidosa in Sewage Treatment Processes, W73-11617 5B

A Solvent Extraction Method for the Determination of Phosphorus-32 in Sea Water, W73-11643 5A

PHOSPHORUS REMOVAL

Characterization of the Activated Sludge Process, W73-11069 5D

Phosphorus Removal, A Bibliography, Volume I, W73-11319 5D

Phosphorus Removal, A Bibliography, Volume 2, W73-11320 5D

PHOTO-FILM PROCESSING

Photographic Water Conservation and Reclamation Processes Study, W73-11403 5A

PHOTODEGRADATION

A Study of the Photodegradation of Commercial Dyes, W73-11325 5B

PHOTOGRAMMETRY

Computer Program System for Aerotriangulation, W73-11518 7C

PHOTOGRAPHIC MENSURATION

Aerial Surveillance Spill Prevention System, W73-11326 5B

PHOTOGRAPHY

Photographic Water Conservation and Reclamation Processes Study, W73-11403 5A

PHOTOSYNTHETIC BACTERIA

Construction of a Purification Plant for Polluted Water Using Photosynthetic Bacteria, W73-11569 5D

PHYCOVIRUSES

Pollution Effects on Phycovirus and Host Algae Ecology, W73-11635 5C

PHYMATOTRICHUM-OMNIVORUM

Influence of Soil Temperature and Moisture on Survival and Growth of Strands of *Phymatotrichum omnivorum*, W73-11248 3F

PHYSIOLOGICAL ECOLOGY

Environmental Terminology Index, W73-11387 10C

PHYTOPHTHORA INFESTANS

Ferrous Iron and the Growth of Twenty Isolates of *Phytophtora infestans* in Synthetic Media, W73-11490 5A

PHYTOPLANKTON

An In Situ Evaluation of Nutrient Effects in Lakes, W73-11070 5C

Limnology of Yellowtail Reservoir and the Big Horn River, W73-11331 5C

Spring Phytoplankton Abundance and Productivity in Grand Traverse Bay, Lake Michigan, 1970, W73-11629 5B

Planktonic Changes Following the Restoration of Lake Trumen, Sweden, W73-11639 5G

PIERS

Removal of Oil From Under Piers, W73-11438 5G

SUBJECT INDEX

POLLUTANT IDENTIFICATION

PIEZODIALYSIS	
Research on Piezodialysis, Third Report, W73-11154	3A
PILES (FOUNDATIONS)	
Ice Forces on Vertical Piles, W73-11538	8B
PILOT PLANTS	
Low Water Volume Enzyme Deactivation of Vegetables Before Preservation, W73-11130	5D
PIMEPHALES PROMELAS	
Survival and Gill Condition of Bluegill (<i>Lepomis macrochirus</i>) and Fathead Minnows (<i>Pimephales promelas</i>) Exposed to Sodium Nitrilotriacetate (NTA) for 28 Days, W73-11621	5C
PINE-G	
Soil Physical Factors Affecting Root Morphology and Stability of Scots Pine on Upland Heaths, W73-11173	4A
PINUS-PATULA-G	
The Effect of Afforestation on Streamflow at Cathedral Peak: Report No. 1, W73-11310	4C
PINUS-RADIATA-G	
The Effect of Environmental Factors on Wood Characteristics: I. The Influence of Irrigation on Pinus Radiata from South Australia, W73-11452	4A
PIPE LININGS	
Cement Mortar Lining of 20-Ft Diameter Steel Pipe, W73-11522	8F
PIPE TESTS	
Determining the Strength of Corroded Pipe, W73-11527	8G
PIPELINES	
Reactor Model Parameters - Two-Phase Reactor Design Tubular Reactors, W73-11138	5F
Determining the Strength of Corroded Pipe, W73-11527	8G
PIPES	
Discrete Gradient Optimization of Water Systems, W73-11365	8B
PIT RECHARGE	
Ground Water Recharge Through Pits and Wells, W73-11053	4B
Artificial Recharge of Groundwater, A Bibliography, W73-11321	4B
PLANNING	
Toward a Philosophy of Planning: Attitudes of Federal Water Planners, W73-11073	6A
Programing Model for Evaluating Economic and Financial Feasibility of Irrigation Projects with Extended Development Periods, W73-11149	3F
An Environmental Evaluation System for Water Resource Planning, W73-11151	6A
Environmental Health Planning, W73-11244	5G
WATER SUPPLY	
Water Supply Plan for the Southeastern Connecticut Region, Volume II, Recommended Plan, W73-11249	6B
Brown County Sewage and Solid Waste Study - 1972, W73-11250	5E
Regional Waste Water, Solid Waste Disposal, Water Supply, and Storm Drainage Systems Appraisal, W73-11252	5G
Public Participation in Urban Water Planning, W73-11257	6B
Comprehensive Water Sewer Plan for Baldwin County, Alabama, W73-11261	5D
Comprehensive Water and Sewer Plan for Escambia County, Alabama, W73-11262	5D
Public Utilities in Winnebago County, W73-11263	3D
Research and Development in Water Resources, Water Resources Research, Its Role in the Total R and D Spectrum, W73-11341	6B
Theory and Practice of Public Participation in Planning, W73-11510	6B
Economic Growth and Environmental Impact: Evaluating Alternatives, W73-11511	6B
PLANT COMMUNITIES	
Plant Communities of Wet Ground in Northeast Cheshire, England, W73-11552	2L
PLANT PIGMENTS	
The Influence of Simazine on the Photosynthetic Pigments of Green Algae, W73-11610	5C
PLANT POPULATIONS	
Study of the Changes in the Structure of Two Algal Populations: An R-Type Factor Analysis, W73-11129	5A
PLANTS	
Lead Accumulation Within Nuclei of Moss Leaf Cells, W73-11276	5E
PLASMA POLYMERIZATION	
A Study of Vapor Phase Polymerization and Crosslinking to Prepare Reverse Osmosis Membranes, W73-11162	3A
PLASTIC HINGES	
Simplified Computer Approach to the Ultimate Load Analysis and Design of Reinforced Concrete Frames, W73-11499	8F
PLOTTERS	
An Individual Approach to Independent Computer Survey, W73-11512	7C
PLOTTING	
An Individual Approach to Independent Computer Survey, W73-11512	7C
PLUGGING (WELLS)	
The Biggest Artesian Well in the World, W73-11481	8A
PLUME MODELS	
Numerical Thermal Plume Model for Vertical Outfalls in Shallow Water, W73-11333	5B
PLYWOOD GLUE WASTES	
Aerobic Secondary Treatment of Plywood Glue Wastes, W73-11065	5D
POINT SOURCE CONTROL	
Colorado River Water Quality Improvement Program, W73-11264	5G
POLAROGRAPHIC ANALYSIS	
Polarographic Method for Nitrate and Dissolved Oxygen Analyses, W73-11662	5A
POLLUTANT EFFECTS	
Survival and Gill Condition of Bluegill (<i>Lepomis macrochirus</i>) and Fathead Minnows (<i>Pimephales promelas</i>) Exposed to Sodium Nitrilotriacetate (NTA) for 28 Days, W73-11621	5C
POLLUTANT IDENTIFICATION	
Fluorescent Probes in the Detection of Insecticides in Water, W73-11061	5A
X-Ray Photoelectron Spectroscopy of Metals in Amino Acid Complexes and Proteins, (Rontgen-Photoelektronenspektroskopie von Metallen in Aminosäurekomplexen und Proteinen), W73-11121	5A
Application of the Fluorescent Antibody Technique to the Differentiation of Aspergillus Species, Candida Species and Zygomycetes in Paraffin Section of Formalin-Fixed Tissues, W73-11126	5A
Isolation of Salmonellae from Moderately Polluted Waters, W73-11134	5A
Occurrence of Salmonella in Oxidation Ditches, W73-11136	5A
Remote Sensing Techniques for Detecting Oil Slicks, W73-11137	5A
Dithizone Procedure for Mercury Analysis, W73-11306	5A
Pyrographic Gross Characterization of Water Contaminants, W73-11446	5A
Spectrophotometric Method for Determination of Ozone in Aqueous Solutions, W73-11495	5A
Petroleum Hydrocarbons and Fatty Acids in Wastewater Effluents, W73-11575	5B
Total Mercury and Methylmercury Content of the American Eel (<i>Anguilla rostrata</i>), W73-11576	6C
Mercury, DDT, and PCB in Harbour Seals (<i>Phoca vitulina</i>) From the Bay of Fundy and Gulf of Maine, W73-11577	5C

SUBJECT INDEX

POLLUTANT IDENTIFICATION

Residues of Chlorinated Hydrocarbon Pesticides in the Northern Quahog (Hard-Shell Clam), <i>Mercenaria mercenaria</i> -1968 and 1969, W73-11579	5C
Mercury in Public Sewer Systems, W73-11585	5D
Mercury in Harbour Porpoises (<i>Phocoena phocoena</i>) From the Bay of Fundy Region, W73-11588	5C
Measurement of Exchangeable Inorganic Phosphate in Lake Sediments, W73-11596	5A
Trace Analysis by Enzyme Inhibition and Activation, W73-11604	5A
Improved Method for Characterizing Environmental Hydrocarbons by Gas Chromatography, W73-11607	5A
New Picogram Detection System Based on a Mass Spectrometer With an External Ionization Source at Atmospheric Pressure, W73-11608	5A
Gas Chromatograph Peaks Identified On-Line by a New Grating Infrared Spectrophotometer, W73-11609	5A
Gas Chromatographic and Mass Spectrometric Studies of S-Alkyl Derivatives of N,N-Dialkyl Dithiocarbamates, W73-11622	5A
2,4,6-Triphenylpyrrolium Chloride. A New Organic Analytical Reagent for the Determination of Certain Anions, W73-11623	5A
Organochlorine Insecticides in Surface Waters in Germany-1970 and 1971, W73-11628	5C
Selective Determination of Copper (II) In Aqueous Media by Enhancement of Flash-Photolytically Initiated Riboflavin Chemiluminescence, W73-11636	5A
Identification of the Constituents of Kraft Pulping Effluent That are Toxic to Juvenile Coho Salmon (<i>Oncorhynchus kisutch</i>), W73-11638	5A
The Heavy Metal Content of Rainfall in the East Midlands, W73-11648	5A
Polarographic Method for Nitrate and Dissolved Oxygen Analyses, W73-11662	5A
POLLUTANTS	
Process for the Removal of Cyanide from Sewage by Means of Formaldehyde, W73-11224	5D
Dithizone Procedure for Mercury Analysis, W73-11306	5A
POLLUTION ABATEMENT	
The Development and Demonstration of an Underwater Oil Harvesting Technique, W73-11063	5G
Development of a Mobile System for Cleaning Oil-Contaminated Beaches, W73-11064	5G

PORE PRESSURE	
Pore Pressure Measurements in Aelotropic Peat, W73-11195	2G
Abnormal Pressures in Deep Wells of Southwestern Louisiana, W73-11464	8E
PORE WATER	
Phosphate in Interstitial Waters of Anoxic Sediments: Oxidation Effects During Sampling Procedure, W73-11118	5B
Relationships Between Volume and Pore-Water Change and Shear Stress in Granular Soils, W73-11197	2G
POTABLE WATER	
Toxic Effects of Trace Elements on the Reproduction of Mice and Rats, W73-11190	5C
Apollo Experience Report, Potable Water System, W73-11202	5F
Copper Determination in Water by Standard Addition Potentiometry, W73-11605	5A
POTASSIUM	
Cation Exchange Separation of Metal Ions With Potassium Chloride-Chelating Agent-Organic Solvent Medium, W73-11311	5A
POTATO-D STARCH	
Studies on the Sources of Pollution in Dairy Water: I. Properties of the Waste Water From Potato Starch Factories (In Japanese), W73-11284	5B
POTATO PROCESSING WASTES	
The Northern Maine Regional Treatment System, W73-11079	5D
POWER GRIDS	
Solution of Problems on Interconnected AC Systems by Means of HVDC Transmission Systems, W73-11521	8C
POWER OPERATION AND MAINTENANCE	
Control of Insulator Contamination in Substations, W73-11506	8C
PRE-IMPOUNDMENT	
Preimpoundment Study, Carters Lake, W73-11530	6G
PREFERENCES (WATER RIGHTS)	
Aesthetic Preference for Water Resource Projects: An Application of Q Methodology, W73-11684	6B
PRESSURE PROBES	
Expansion of Cylindrical Probes in Cohesive Soils, W73-11520	8D
PRESSURE SEWER SYSTEM	
Phosphorus in Waste Water, W73-11592	5D
PRICING	
Peak Load Pricing Model of an Electric Utility Using Pumped Storage, W73-11146	6A

SUBJECT INDEX

RADIOACTIVE WASTE DISPOSAL

PRIMARY PRODUCTION	PSEUDOMONAS DESMOLYTICA	Sublethal Effects of Bleached Kraft Pulp Mill Effluent on Respiration and Circulation in Sockeye Salmon (<i>Oncorhynchus nerka</i>).
Limnology of Yellowtail Reservoir and the Big Horn River, W73-11331	Biological Oxidation of the Hydrocarbons in Aqueous Phase, W73-11132	W73-11615 SC
PRIMARY PRODUCTIVITY	PUBLIC BENEFITS	Effects of a 12-Hr and 25-Day Exposure to Kraft Pulp Mill Effluent on the Blood and Tissues of Juvenile Coho Salmon (<i>Oncorhynchus kisutch</i>).
An In Situ Evaluation of Nutrient Effects in Lakes, W73-11070	A Water System Designed to Attract Industry, W73-11317	W73-11620 SC
The Relationship of Enzyme Kinetic Heterotrophy Analysis to Other Eutrophication Indices, W73-11432	PUBLIC HEALTH	Identification of the Constituents of Kraft Pulping Effluent That are Toxic to Juvenile Coho Salmon (<i>Oncorhynchus kisutch</i>).
Carbon Dioxide Dynamics: A Record of Organic Carbon Production, Respiration, and Calcification in the Eniwetok Reef Flat Community, W73-11488	Composition of Airborne Lead Particles, W73-11188	W73-11638 SA
Spring Phytoplankton Abundance and Productivity in Grand Traverse Bay, Lake Michigan, 1970, W73-11629	Environmental Health Planning. W73-11244	SA
Tropical Role of Bacteria in the Ecosystem of the Coral Reef, W73-11632	Environmental Contamination by Lead from a Mine and Smelter, W73-11267	5A
Planktonic Changes Following the Restoration of Lake Trumen, Sweden, W73-11639	PUBLIC INTERESTS	PUMP TESTING
A Comparison of Benthic Microalgal Production Measured by C-14 and Oxygen Methods, W73-11658	Public Participation in Urban Water Planning, W73-11257	Optimum Hole Diameter for Water Wells, W73-11468 SA
PROBABILITY THEORY	PUBLIC OPINION	PUMPED STORAGE
A Probabilistic Approach to Maximum Column Strength, W73-11516	Theory and Practice of Public Participation in Planning, W73-11510	Peak Load Pricing Model of an Electric Utility Using Pumped Storage, W73-11146 6A
PRODUCTIVITY	PUBLIC PARTICIPATION	PUMPING
Population Studies of three Aquatic Gastropods in an Intermittent Backwater, W73-11494	Public Participation in Urban Water Planning, W73-11257	Groundwater Regime in the Zone of Influence of Pumping (Rezhim gruntovykh vod v zone viyaniya vertikal'nogo drenazha), W73-11094 4B
PROGRAMS	PUBLIC UTILITIES	PURE CULTURES
Environmental Health Planning. W73-11244	Community Improvements and Service Costs, W73-11255	Pesticide Degradation by Marine Algae, W73-11601 5B
PROJECT PLANNING	PUBLICATIONS	PYRITES
Construction Difficulty Index for Tunnel Construction, W73-11681	A Catalog of Hydroclimatological Data for Alaska's Coastal Zone, W73-11056	Oxidation of Pyrites in Chlorinated Solvents, W73-11068 5D
PROJECTS	Housing and Planning References. W73-11251	PYROGRAPHIC METHODOLOGY
Aesthetic Preference for Water Resource Projects: An Application of Q Methodology, W73-11684	PUERTO RICO	Pyrographic Gross Characterization of Water Contaminants, W73-11446 5A
PROPYLENE CARBONATE	A Study of Coastal Water Quality in the Vicinity of San Juan, Puerto Rico, January 13-31, 1971. W73-11388	QUALITY CONTROL
Determination of Phenols and Aromatic Amines by Direct Titration with Bromine in Propylene Carbonate, W73-11485	PULMONATE SNAILS	Ultraceptivity in Trace Analysis, W73-11483 5A
PROTEINS	The Effects of Temperature on Growth and Reproduction of Aquatic Snails, W73-11444	RADAR
X-Ray Photoelectron Spectroscopy of Metals in Amino Acid Complexes and Proteins, (Rontgen-Photoelektronenspektroskopie von Metallen in Aminosäurekomplexen und Proteinen), W73-11121	PULP AND PAPER INDUSTRY	Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering, W73-11631 5A
PROTEUS VULGARIS	State-of-the-Art Review of Pulp and Paper Waste Treatment, W73-11080	RADIAL COLLECTOR WELLS
Enumeration and Differentiation of Water Bacteria with Phosphorus-32, W73-11133	PULP WASTES	Radial Collector Well Solves Water Supply Problem, W73-11473 8B
	Steam Stripping Odorous Substances from Kraft Effluent Streams (SEKOR), W73-11060	RADIAL PROPAGATION (PLANTS)
	State-of-the-Art Review of Pulp and Paper Waste Treatment, W73-11080	Radial Propagation of Water Potential in Stems, W73-11181 3F
	A Control System for Mill Effluent Disposal, W73-11312	RADIATION
	Impairment of the Flavor of Fish by Water Pollutants, W73-11322	Survey of Application of Radiation to Preparative Chemistry, W73-11119 2K
	Organic Loading of Petenwell Reservoir, Wisconsin, W73-11486	RADIOACTIVE DATING
		Accretion Rates of Freshwater Manganese Deposits, W73-11088 2J
		RADIOACTIVE WASTE DISPOSAL
		Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington, W73-11204 5B

SUBJECT INDEX

RADIOACTIVE WASTES

RADIOACTIVE WASTES
Radionuclides in Transport in the Columbia River from Pasco to Vancouver, Washington, W73-11549 5B

Disposal of Uranium-Mill Effluent by Well Injection in the Grants Area, Valencia County, New Mexico, W73-11551 5E

RADIOACTIVITY TECHNIQUES
Enumeration and Differentiation of Water Bacteria with Phosphorus-32, W73-11133 5A

A Small Dimension Probe for the Determination of Ground Water Flow Direction, W73-11200 2F

Multi-Element Neutron Activation Analysis of Sediment Using a Californium-252 Source, W73-11644 5A

A Comparison of Benthic Microalgal Production Measured by C-14 and Oxygen Methods, W73-11658 5A

RADIOCHEMICAL ANALYSIS
Application of Radiochemical Methods in Environmental Research, (Anwendung Radiochemischer Methoden in der Umweltforschung), W73-11125 5A

Phenylmercur Acetate: Metabolic Conversion by Microorganisms, W73-11187 5B

RADIOISOTOPES
Radionuclides in Transport in the Columbia River from Pasco to Vancouver, Washington, W73-11549 5B

RADIOMETRY
Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering, W73-11631 5A

RAINBOW TROUT
Effects of Chemical Variations in Aquatic Environments: Volume II, Toxic effects of aqueous aluminum to rainbow trout, W73-11075 5C

Effects of Chemical Variations in Aquatic Environments: Volume III, Lead Toxicity to Rainbow Trout and Testing Application Factor Concept, W73-11076 5C

Acute Zinc Toxicity to Rainbow Trout (*Salmo gairdneri*): Confirmation of the Hypothesis that Death is Related to Tissue Hypoxia, W73-11180 5C

Temperature Effects on Mercury Accumulation, Toxicity, and Metabolic Rate in Rainbow Trout (*Salmo gairdneri*), W73-11655 5C

RAINFALL
A Model for Rain Erosion of Homogeneous Materials, W73-11560 8G

The Heavy Metal Content of Rainfall in the East Midlands, W73-11648 5A

RAINFALL-RUNOFF RELATIONSHIPS
Hydraulics of Shallow Flows Over Stable Eroded Sand Surfaces Defined by Area Spectra, W73-11192 2A

Effects of Urbanization on Floods in the Houston, Texas, Metropolitan Area, W73-11402 4C

Mathematical Methods in the Theory and Practice of Mountain Streamflow Computation and Forecasting (Matematicheskiye metody v teorii i praktike raschetov i prognozov stoka gornykh rek). W73-11406 4A

RAINFALL SIMULATORS
Hydraulics of Shallow Flows Over Stable Eroded Sand Surfaces Defined by Area Spectra, W73-11192 2A

RAPID CITY (S DAK)
Flood of June 9-10, 1972, at Rapid City, South Dakota, W73-11105 7C

REAGENTS
Ultrapurity in Trace Analysis, W73-11483 5A

2,4,6-Triphenylpyrylium Chloride. A New Organic Analytical Reagent for the Determination of Certain Anions, W73-11623 5A

RECHARGE WELLS
Ground Water Recharge Through Pits and Wells, W73-11053 4B

Artificial Recharge of Groundwater, A Bibliography, W73-11321 4B

RECOVERY
Recovery of Salt Marsh Vegetation From Successive Oil Spillages, W73-11649 5C

RECREATION
Application of Remote Sensing Techniques to Measurement of Use of Outdoor Recreation Resources, W73-11546 7B

RECREATION FACILITIES
Application of Remote Sensing Techniques to Measurement of Use of Outdoor Recreation Resources, W73-11546 7B

RECREATIONAL USE
Ecologic-Economic Analysis for Regional Development. Some Initial Explorations with Particular Reference to Recreational Resource Use and Environmental Planning, W73-11176 6B

RECYCLING
Marine Sanitation System Demonstration, W73-11059 5D

RED RIVER VALLEY (ARK)
Water Resources of Hempstead, Lafayette, Little River, Miller, and Nevada Counties, Arkansas, W73-11222 4B

REDUCTION (CHEMICAL)
Oxygen Deficient Conditions and Nitrate Reduction in the Eastern Tropical North Pacific Ocean, W73-11589 5A

REEFS
Tropical Role of Bacteria in the Ecosystem of the Coral Reef, W73-11632 5A

Small-Scale Experiments to Determine the Effects of Crude Oil Films on Gas Exchange Over the Coral Back-Reef at Heron Island, W73-11650 5C

REFLECTANCE
Remote Sensing Techniques for Detecting Oil Slicks, W73-11137 5A

REGIMEN
Formation and Forecast of Components in the Hydrologic Regimen of Rivers (Formirovaniye i prognozy elementov gidrologicheskogo rezhima rek). W73-11688 2E

REGIONAL ANALYSIS
The Northern Maine Regional Treatment System, W73-11079 5D

REGIONAL DEVELOPMENT
Ecologic-Economic Analysis for Regional Development. Some Initial Explorations with Particular Reference to Recreational Resource Use and Environmental Planning, W73-11176 6B

REGIONAL TREATMENT
The Northern Maine Regional Treatment System, W73-11079 5D

REGRESSION ANALYSIS
Application of Regression Analysis to the Study of Background Variations in Trace Metal Content of Stream Sediments, W73-11179 5A

Probabilistic Short-Term River Yield Forecasts, W73-11366 4A

Relationships between Moisture Retention and Particle Size Distribution of the Soil, W73-11634 2G

REINFORCED CONCRETE
Flexural Fatigue Strength of Steel Fiber Reinforced Concrete Beams, W73-11498 8F

Simplified Computer Approach to the Ultimate Load Analysis and Design of Reinforced Concrete Frames, W73-11499 8F

Torsional Stiffness of Reinforced Concrete Members Subjected to Pure Torsion, W73-11519 8F

Internal Cracking in Reinforced Concrete Members, W73-11523 8F

REINFORCING MATERIALS
Flexural Fatigue Strength of Steel Fiber Reinforced Concrete Beams, W73-11498 8F

SUBJECT INDEX

RETURN FLOW

RELIABILITY	Zum Bewegungsverhalten Von Einzelligen Fliesswasseralgen, W73-11626	5C	Forecasting Quarterly Inflow of Water to Dnieper River Reservoirs During the Cold Half of the Year (O prognozirovani kvarthal'nogo pritoka vody v dneprovskiye vodokhranilishcha za kholodnyu polovinu goda), W73-11691	2H
A Simple Microscale Vacuum Collector for the Elution of Closely Situated Spots from Thin- Layer Chromatograms, W73-11657	5A			
An Improved Ekman-Type Grab, W73-11659	5A			
REMOTE SENSING				
Direct Determination of the Electromagnetic Reflection Properties of Smooth Brackish Water to the Continuous Spectrum from 100 million to 4 billion Hertz, W73-11052	2L			
Unsupervised Spatial Clustering with Spectral Discrimination, W73-11116	7C			
Remote Sensing Techniques for Detecting Oil Slacks, W73-11137	5A			
An Evaluation of the Utility of Available Remote Sensor Returns for a Study of Slope Failure Phenomena, W73-11216	7B			
An Investigation of Environmental Pollution by Lead and Other Heavy Metals from Industrial Development in Southeastern Missouri, W73-11270	5B			
Aerial Surveillance Spill Prevention System, W73-11326	5B			
The Inference of Atmospheric Ozone Using Satellite Nadir Measurements in the 1042/CM Band, W73-11400	7B			
Remote Sensing Evaluation of Environmental Factors Affecting the Developmental Capacity of Inland Lakes, W73-11540	7B			
Investigation of Infrared Anomalies in the Lac Des Deux Montagnes Area, Quebec, W73-11541	7B			
Application of Remote Sensing Techniques to Measurement of Use of Outdoor Recreation Resources, W73-11546	7B			
Applications of Multispectral Remote Sensing Techniques to Hydrobiological Investigations In Everglades National Park, W73-11553	7B			
Natural Resource Information System Remote Sensing Studies, W73-11571	7B			
Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering, W73-11631	5A			
REPAIRING				
Wet Well Woes, W73-11462	8A			
REPETITIVE SCANNING				
Comparison of Selective Ion Monitoring and Repetitive Scanning During Gas Chromatog- raphy-Mass Spectrometry, W73-11493	5A			
REPOPULATION				
Experiments on the Movement Behavior of Single-Cell Flowing Water Algae, (Experimente				
REPRODUCTION				
Toxic Effects of Trace Elements on the Reproduction of Mice and Rats, W73-11190	5C			
The Effects of Temperature on Growth and Reproduction of Aquatic Snails, W73-11444	5C			
RESEARCH AND DEVELOPMENT				
Research and Development in Water Resources, Water Resources Research, Its Role in the Total R and D Spectrum, W73-11341	6B			
RESEARCH PRIORITIES				
Research and Development in Water Resources, Water Resources Research, Its Role in the Total R and D Spectrum, W73-11341	6B			
Iron Bacteria--A Likely Subject of Co-Or- dered Research, W73-11471	5B			
RESEARCH PROGRAMS				
National Meat-Packaging Waste Management Research and Development Program, W73-11440	5D			
RESERVOIR CONSTRUCTION				
Bituminous Blanket for Dike at Ludington Pumped Storage Project, W73-11504	8F			
RESERVOIR OPERATION				
Iterative Simulation Algorithm in Reservoir Systems Operation, W73-11139	4A			
River Systems Transition Function and Opera- tion Study, W73-11364	4A			
RESERVOIR STORAGE				
Iterative Simulation Algorithm in Reservoir Systems Operation, W73-11139	4A			
Reservoir Bank Storage, W73-11542	2H			
Forecasting Quarterly Inflow of Water to Dnieper River Reservoirs During the Cold Half of the Year (O prognozirovani kvarthal'nogo pritoka vody v dneprovskiye vodokhranilishcha za kholodnyu polovinu goda), W73-11691	2H			
RESERVOIRS				
Stochastic Reservoir Management and System Design for Irrigation, W73-11152	3F			
Bathymetric Reconnaissance of Wild Horse Reservoir, Elko County, Nevada, W73-11219	7C			
Bathymetric Reconnaissance of Weber Reser- voir, Mineral County, Nevada, W73-11220	7C			
Preimpoundment Study, Carters Lake. W73-11530	6G			
Reservoir Bank Storage, W73-11542	2H			
RESTORATION				
Planktonic Changes Following the Restoration of Lake Trumen, Sweden, W73-11639	5G			
RETENTION				
Hydraulics of Shallow Flows Over Stable Eroded Sand Surfaces Defined by Area Spec- tra, W73-11192	2A			
RETURN FLOW				
Prediction Modeling for Salinity Control in Ir- rigation Return Flows, W73-11441	5G			

SUBJECT INDEX

RETURN FLOW

Rehabilitation of Irrigation Systems for Salinity Control, W73-11509	3F	RHODOTORULA RUBRA Continuous Culture of Rhodotorula rubra: Kinetics of Phosphate-Arsenate Uptake, Inhibition, and Phosphate-Limited Growth, W73-11574	5A	Characteristics of Ice-Jam Formation on the Soviet Reach of The Danube (Osobennosti zatoorobrazovaniya na sovetskem uchastke Durnaya), W73-11694	2C
REVERSE OSMOSIS		RIBOFLAVIN		ROAD CONSTRUCTION	
The Mechanism of Formation of 'Skinned' Type Membranes and Their Characterization, W73-1153	3A	Selective Determination of Copper (II) In Aqueous Media by Enhancement of Flash- Photolytically Initiated Riboflavin Chemiluminescence, W73-11636	5A	Effects of Roadway and Pond Construction on Sediment Yield Near Harrisburg, Pennsylvania, W73-11700	2J
Investigation of Polybenzimidazole Hollow Fiber Reverse Osmosis Desalination Mem- branes, W73-1157	3A	RIO GRANDE PROJECT		ROCK BOLTS	
Research on Reverse Osmosis Membranes for Purification of Wash Water at Sterilization Temperature (165F), W73-1159	3A	Progress Report of Residue Studies on Organic Arsenicals used for Ditchbank Weed Control, W73-11497	4A	Study of the Behavior of a Roof with Various Bolting Systems, W73-11503	8E
Investigation of Phase and State Relations in Complex Lipid Systems, W73-1161	3A	RIVER BASINS		ROCK MECHANICS	
A Study of Vapor Phase Polymerization and Crosslinking to Prepare Reverse Osmosis Mem- branes, W73-1162	3A	Distribution of Average Turbidity of Rivers in the Armenian SSR (Raspredeleniye sredney mutnosti rek po territorii Armyanskoy SSR), W73-11099	2E	Study of the Behavior of a Roof with Various Bolting Systems, W73-11503	8E
A Neutron Spectroscopic Study of the Diffus- ive Kinetics and Interactions of Water in Dense Layer Desalination Membranes, W73-1165	3A	Sediment Records of the Snowy Mountains Re- gion, Australia. W73-11572	2J	ROCKS	
Reverse Osmosis Water Purifying System with Gradient Barrier Water Storage Container, W73-1156	3A	Linear Programming use for Evaluating Water Resources and Cost and Benefit Allocation, W73-11683	6A	Determination of Trace Mercury in Soil and Rock Media, W73-11297	5A
REVERSE-PHASE THIN LAYER		RIVER FLOW		RODENTS	
CHROMATOGRAPHY		Probabilistic Short-Term River Yield Forecasts, W73-11366	4A	Toxic Effects of Trace Elements on the Reproduction of Mice and Rats, W73-11190	5C
A Quantitative, Semiroutine Method for Deter- mining Algal and Sedimentary Chlorophyll Derivatives, W73-11637	5A	RIVER SYSTEMS		ROOF BOLTS	
REVIEWS		River Systems Transition Function and Opera- tion Study, W73-11364	4A	Study of the Behavior of a Roof with Various Bolting Systems, W73-11503	8E
Solvent Extraction Status Report, W73-11066	5D	RIVERS		ROOF DRAIN REMOVAL	
The Northern Maine Regional Treatment System, W73-11079	5D	Inflow to Rivers in the Pamirs (Pitaniye rek Pamira), W73-11096	2C	Reduction of Hydraulic Sewer Loadings by Downspout Removal, W73-11671	4A
State-of-the-Art Review of Pulp and Paper Waste Treatment, W73-11080	5D	Distribution of Average Turbidity of Rivers in the Armenian SSR (Raspredeleniye sredney mutnosti rek po territorii Armyanskoy SSR), W73-11099	2E	ROOT ELONGATION	
Water Analysis, W73-11285	2K	Investigation of Seasonal Variability of Runoff on Rivers in the Altay and Sayan Mountain Systems (Issledovaniye vnutrigodovoy nerav- nomernosti stoka rek Altaya i Sayana), W73-11101	2E	The Response of Native Montana Grasses to Soil Water Stress, W73-11429	2I
Prediction Modeling for Salinity Control in Ir- rigation Return Flows, W73-11441	5G	Probabilistic Short-Term River Yield Forecasts, W73-11366	4A	ROOT NODULES	
Living Foraminiferids of Tidal Marshes: A Review, W73-11502	2L	Formation and Forecast of Components in the Hydrologic Regimen of Rivers (Formirovaniye i prochnost elementov hidrologicheskogo rezhima rek), W73-11688	2E	The Effects of Water Stress on Nitrogen-fixing Root Nodules: II. Effects of the Fine Structure of Detached Soybean Nodules, W73-11415	3F
Smithsonian Advisory Committee Report on Studies of the Effects of Waste Disposal in the New York Bight, W73-11642	5C	Experiment in the Use of Digital Computers to Determine Traveltime on a Tributary Reach of A River (Opty ipol'zovaniya ETsVM pri opredelenii vremeni dobeganiya na pritochnom uchastke reki), W73-11692	2E	ROOTS	
RHIZOSPHERE		Use of Digital Computers to Compute Propaga- tion of Flood Waves Along the Cascade of Reservoirs on the Dnieper River (Primenenie ETsVM dlya rascheta rasprostraneniya voln polovodiy po kaskadu gidrouzov na Dnepre), W73-11693	2E	Soil Physical Factors Affecting Root Morphology and Stability of Scots Pine on Upland Heaths, W73-11173	4A
Response of Relative Water Content in Zea Mays L. to Changes of Potential in the Rhizo- sphere and Atmosphere, W73-11145	3F	ROTARY DRILLING			
RHODE ISLAND		New Bits Can Drill More Hole, W73-11457	8B		
Protection and Control of the Salt Water Shore Area. W73-11114	6E	New Down-Hole Tools Improve Drilling, W73-11458	8B		
		Rotary Rig Due for Face-Lifting, W73-11459	8B		
		ROTATING BIOLOGICAL CONTACTOR			
		Cannery Wastewater Treatment with Rotating Biological Contactor and Extended Aeration, W73-11058	5D		
		RUNOFF			
		Inflow to Rivers in the Pamirs (Pitaniye rek Pamira), W73-11096	2C		
		Investigation of Seasonal Variability of Runoff on Rivers in the Altay and Sayan Mountain			

SUBJECT INDEX

SATURATION

Systems (Issledovaniye vnutrigodovoy neravnomernosti stoka rek Altaya i Sayan).		
W73-11101	2E	
Investigation of the Dynamics and Calculation of the Losses of Spring Runoff in a Small River Basin (Issledovaniye dinamiki i rascheta poteri vesennego stoka v malom rechnom basseyne).		
W73-11690	2E	
RUNOFF FORECASTING		
Effects of Urbanization on Floods in the Houston, Texas, Metropolitan Area,		
W73-11402	4C	
S-ETHYL N,N-DIALKYL DITHiocarbamates		
Gas Chromatographic and Mass Spectrometric Studies of S-Alkyl Derivatives of N,N-Dialkyl Dithiocarbamates,		
W73-11622	5A	
S-N-PROPYL N,N-DIALKYL DITHiocarbamates		
Gas Chromatographic and Mass Spectrometric Studies of S-Alkyl Derivatives of N,N-Dialkyl Dithiocarbamates,		
W73-11622	5A	
SACRAMENTO RIVER (CAL.)		
Nonlinear Parameter Estimation in Water Quality Modeling,		
W73-11361	5B	
SALINITY		
Direct Determination of the Electromagnetic Reflection Properties of Smooth Brackish Water to the Continuous Spectrum from 100 million to 4 billion Hertz,		
W73-11052	2L	
Colorado River Water Quality Improvement Program.		
W73-11264	5G	
Environmental Effects on Toxaphene Toxicity to Selected Fishes and Crustaceans,		
W73-11323	5C	
Research and the Problems of Two Seas,		
W73-11350	2L	
Volume Transport, Salinity Distribution and Net Circulation in the Duplin Estuary, Georgia,		
W73-11425	2L	
Prediction Modeling for Salinity Control in Irrigation Return Flows,		
W73-11441	5G	
Salinity Control on a Borehole Source in Bunter Sandstone,		
W73-11469	4B	
Rehabilitation of Irrigation Systems for Salinity Control.		
W73-11509	3F	
Physical-Chemical Oceanographic Data from the North Pacific Ocean and Bering Sea, 1971,		
W73-11595	5A	
SALINITY CONTROL		
Salinity Control on a Borehole Source in Bunter Sandstone,		
W73-11469	4B	
SALMON		
Effects of Logging on Growth of Juvenile Coho Salmon,		
W73-11433	5C	
Effects of a 12-Hr and 25-Day Exposure to Kraft Pulp Mill Effluent on the Blood and Tissues of Juvenile Coho Salmon (<i>Oncorhynchus kisutch</i>),		
W73-11620	5C	
SALMONELLA		
Isolation of <i>Salmonellae</i> from Moderately Polluted Waters,		
W73-11134	5A	
Occurrence of <i>Salmonella</i> in Oxidation Ditches,		
W73-11136	5A	
SALMONID FISHES		
Survival Potential of F1 Hybrids Among Salmonid Fishes,		
W73-11653	8I	
SALT MARSHES		
Recovery of Salt Marsh Vegetation From Successive Oil Spillages,		
W73-11649	5C	
SAMPLE INLET		
Recent Developments in the Analytical Application of UV Photoelectron Spectroscopy,		
W73-11489	5A	
SAMPLE PREPARATION		
Determination of Mercury Contents in Diverse Samples of Fish and Other Biological Materials by Neutron Activation Analysis, (Neutronenaktivierungsanalytische Bestimmungen von Quecksilbergehalten in Diversen Fischproben und anderen Biologischen Materialien),		
W73-11123	5A	
Partitioning of a Brackish Water Habitat by Copepod Species,		
W73-11130	5A	
Dursban (Trademark) and Diazinon Residues in Biota Following Treatment of Intertidal Plots on Cape Cod - 1967-69,		
W73-11627	5C	
Influence of Lead and Other Metals on Fish Delta-Aminolevulinate Dehydrase Activity,		
W73-11646	5A	
SAMPLE PRESERVATION		
A Centrifuge Method for Determining Live Weights of Aquatic Insect Larvae, with a Note on Weight Loss in Preservative,		
W73-11647	5A	
SAMPLES		
Analysis of Sea Water by Difference Chromatography. Summary of Progress 1972,		
W73-11584	5A	
SAMPLING		
Method and Apparatus for Detecting the Hardness Level of Water,		
W73-11227	7B	
Waste Water Sampler,		
W73-11243	5A	
Heavy Metals: Fallout Around a Power Plant,		
W73-11282	5A	
An Improved Ekman-Type Grab,		
W73-11659	5A	
Sampling Procedures and Problems in Determining Pesticide Residues in the Hydrologic Environment,		
W73-11660	5A	
SAMPLING EQUIPMENT		
A Flow Proportional Composite Sampler,		
W73-11463	5A	
SAN JOAQUIN VALLEY (CAL.)		
Programming Model for Evaluating Economic and Financial Feasibility of Irrigation Projects with Extended Development Periods,		
W73-11149	3F	
SAN JUAN AREA (PR)		
A Study of Coastal Water Quality in the Vicinity of San Juan, Puerto Rico, January 13-31, 1971.		
W73-11388	5B	
SAN LUIS SERVICE AREA (CALIF.)		
Possibility of Reducing Nitrogen in Drainage Water By On Farm-Practices, (Bio-Engineering Aspects of Agricultural Drainage, San Joaquin Valley, California).		
W73-11324	5B	
SAND		
Measurement of Contact Angle of Water in Soils and Sand,		
W73-11273	2G	
SAND WASHING		
Development of a Mobile System for Cleaning Oil-Contaminated Beaches,		
W73-11064	5G	
SANDIA FOOTHILLS (NEW MEXICO)		
City of Albuquerque Sandia Foothills Drainage.		
W73-11668	4A	
SANDS		
Relationships Between Volume and Pore-Water Change and Shear Stress in Granular Soils,		
W73-11197	2G	
Sand Transport by the Eel River and Its Effect on Nearby Beaches,		
W73-11559	2L	
SANITARY ENGINEERING		
A Water System Designed to Attract Industry,		
W73-11317	5F	
Taste and Odor Control in Water,		
W73-11318	5F	
SANTA CRUZ HARBOR (CALIF.)		
A Case History of Santa Cruz Harbor, California,		
W73-11092	8B	
SATELLITES (ARTIFICIAL)		
Unsupervised Spatial Clustering with Spectral Discrimination,		
W73-11116	7C	
Apollo Experience Report, Potable Water System,		
W73-11202	5F	
SATURATED FLOW		
Relationships Between Saturated Hydraulic Conductivity and Morphometric Data of an Argillite Horizon,		
W73-11211	2G	
SATURATION		
Behaviour of Fine Sands and Silts During the Rise of Ground-Water Level,		
W73-11194	2G	

SUBJECT INDEX

SAWDUST

SAWDUST					
Macrobenthic Ecology of a Sawdust-Bearing Substrate in the Penobscot River Estuary (Maine), W73-11602	5C	Impact of Natural and Man-Made Surface Films on the Properties of the Air-Sea Interface, W73-11371	5B	The Seasonal Cycle of Vitamin B12 in the Strait of Georgia, British Columbia, W73-11578	2L
SCALE PREVENTION		Some Aspects of the Geochemistry of Marine Aerosols, W73-11372	2K	SEASONAL VARIATION	
Softening of Sea Water By Addition of Barium Carbonate and CO ₂ , W73-11236	5F	The Chemical Stability of the Oceans and the CO ₂ System, W73-11374	2K	Pesticides in Water, W73-11618	5B
Softening of Sea Water by Addition of Barium Carbonate and Mineral Acid, W73-11237	5F	Mercury—A Case Study of Marine Pollution, W73-11375	5B	SEAWATER	
SCALING		Microbial Activity as a Biogeochemical Factor in the Ocean, W73-11378	5B	Distribution of Dissolved Mercury in the Irish Sea, W73-11293	5B
Softening of Sea Water by Addition of Barium Carbonate and Mineral Acid, W73-11237	5F	On The Age of Stable Organic Matter—Aquatic Humus in Oceanic Waters, W73-11379	5B	SECONDARY RECOVERY (OIL)	
SCALLOPS		Chemical Cycles with Energy Circuit Models, W73-11381	2A	Development and Preliminary Design of a Sorbent-Oil Recovery System, W73-11071	5G
The Occurrence and Seasonal Variation of Trace Metals in the Scallops <i>Pecten maximus</i> (L.) and <i>Chlamys opercularis</i> (L.), W73-11624	5A	Geological, Geochemical and Environmental Implications of the Marine Dust Veil, W73-11383	5B	SECONDARY TREATMENT	
SCHISTOSOMIASIS		Manganese Nodules and Budget of Trace Solubles in Oceans, W73-11384	5B	Sludge Concentration, W73-11357	5D
Studies on Schistosomiasis in Mekong Basin: II. Malacological Investigations on Human Schistosoma from Laos, W73-11633	5C	Sulfate Reduction, Pyrite Formation, and the Oceanic Sulfur Budget, W73-11386	5B	SEDIMENT DEPOSITION	
SCINTILLATION COUNTING		Some Problems in the Geochemistry of Molybdenum in the Mediterranean Sea (Nekotorye voprosy geokhimii molibdene v Sredizemnom more), W73-11410	2K	Sand Transport by the Eel River and Its Effect on Nearby Beaches, W73-11359	2L
A Solvent Extraction Method for the Determination of Phosphorus-32 in Sea Water, W73-11643	5A	Anodic Stripping Voltammetry at a Tubular Mercury-Covered Graphite Electrode, W73-11484	5A	SEDIMENT LOAD	
SCOUR		Preliminary Report, (RV Thomas G. Thompson Cruise 66), W73-11583	5A	Fluvial Sediment in Sixmile Creek Subwatershed 6, Near Chismville, Arkansas, W73-11082	2J
Scour and Fill in Tujunga Wash—A Fanhead Valley in Urban Southern California—1969, W73-11550	2J	Removal of Oil From Water Surfaces By Sorption on Unstructured Fibers, W73-11586	5G	Effects of Logging on Periphyton in Coastal Streams of Oregon, W73-11582	5C
SCULPINS		Dispersed and Particulate Petroleum Residues in the Gulf of St. Lawrence, W73-11612	5B	SEDIMENT TRANSPORT	
Biological Effects of Fluctuating Water Levels in the Snake River, Grand Teton National Park, Wyoming, W73-11594	2E	A Solvent Extraction Method for the Determination of Phosphorus-32 in Sea Water, W73-11643	5A	Onshore-Offshore Sand Transport on Del Monte Beach, California, W73-11086	2J
SEA SPRAY		SEALANTS		Effects of Land Use and Retention Practices on Sediment Yields in the Stony Brook Basin, New Jersey, W73-11113	4C
Some Aspects of the Geochemistry of Marine Aerosols, W73-11372	2K	Evaluation of Pollution Abatement Procedures Moraine State Park, W73-11062	5G	Hydraulic Model Measurements of Tidal Currents Around Cape Henlopen, Delaware, W73-11203	2L
SEA WATER		Hydrogeologic Considerations for Sealing Coal Mines, W73-11675	5G	Sand Movement Along Carmel River State Beach, Carmel, California, W73-11557	2L
A Study of Vapor Phase Polymerization and Crosslinking to Prepare Reverse Osmosis Membranes, W73-11162	3A	SEASONAL		Sand Transport by the Eel River and Its Effect on Nearby Beaches, W73-11559	2L
Organic Materials in the Marine Environment and the Associated Metallic Elements, W73-11184	5B	Investigation of Seasonal Variability of Runoff on Rivers in the Altay and Sayan Mountain Systems (Issledovaniye vnutrigodovoy neravnomernosti stoka rek Altaya i Sayan), W73-11101	2E	Sediment Records of the Snowy Mountains Region, Australia. W73-11572	2J
Atomic Absorption Spectrophotometry in the Field of Marine Research, W73-11298	5A	SEDIMENT-WATER EQUILIBRATION SYSTEMS		Effects of Roadway and Pond Construction on Sediment Yield Near Harrisburg, Pennsylvania, W73-11700	2J
Mercury in the Marine Environment: Concentration in Sea Water and in a Pelagic Food Chain, W73-11300	5C	Measurement of Exchangeable Inorganic Phosphate in Lake Sediments, W73-11596	5A		
The Changing Chemistry of the Oceans. W73-11367	5B	SEEDLING YIELD			
Nitrous Oxide in Air and Sea Water over the Atlantic Ocean, W73-11370	5B	Effects of Land Use and Retention Practices on Sediment Yields in the Stony Brook Basin, New Jersey, W73-11113	4C		
		Watershed Research, W73-11534	2A		

SUBJECT INDEX

SEWAGE SLUDGE

Effects of Roadway and Pond Construction on Sediment Yield Near Harrisburg, Pennsylvania, W73-11700	2J	
SEDIMENTARY ROCKS		
Calcite Saturation in an Eastern Kentucky Karst Stream, W73-11391	2K	
SEDIMENTATION		
Accretion Rates of Freshwater Manganese Deposits, W73-11088	2J	
Physical Erosion and Denudation Rates in Cartwright Basin and Vicinity, Williamson County, Tennessee, W73-11140	2J	
Man's Role in the Major Sedimentary Cycle, W73-11382	5B	
Geological, Geochemical and Environmental Implications of the Marine Dust Veil, W73-11383	5B	
Sedimentation in the Deep-Sea Areas Adjacent to the Canary and Cape Verde Islands, W73-11393	2J	
Sediments in the Atlantic Corner Seamounts: Control by Topography, Paleo-Winds, and Geochemically-Detected Modern Bottom Currents, W73-11394	2J	
Hydraulic Design of Stilling Basin for Pipe or Channel Outlets, W73-11533	8B	
Scour and Fill in Tujunga Wash-A Fanhead Valley in Urban Southern California-1969, W73-11550	2J	
Numerical Techniques Applied to Particle Deposition During Slot Flow, W73-11697	2J	
SEDIMENTATION RATES		
Physical Erosion and Denudation Rates in Cartwright Basin and Vicinity, Williamson County, Tennessee, W73-11140	2J	
The Use of Modern Chromium Accumulations to Determine Estuarine Sedimentation Rates, W73-11392	2L	
SEDIMENTS		
Phosphorus Release from Lake Sediments, W73-11072	5C	
Upper Permian Glaciomarine Deposits in the Kolyma River Basin (Verkhnepermskiye ledovo-morskiye otlozheniya basseyna istokov r. Kolomy), W73-11103	2J	
Mercury Accumulation by <i>Myriophyllum Spicatum</i> L., W73-11168	5C	
Volcanic Exhalations and Metal Enrichments at Matupi Harbor, New Britain, T.P.N.G., W73-11292	5B	
Role of Iron Sulfides in the Accumulation of Trace Elements in Black Sea Sediments (Rol'sul'fidov zhelez pri nakoplenii mikroelementov v osadkakh Chernogo morya), W73-11409	2J	
Conditions of Preservation of Chlorophyll, Pheophytin, and Humic Substances in Black Sea Sediments (Uslovija sokhrannosti khlorofilla, feofitina i guminovykh veshchestv v otlozheniyakh Chernogo morya), W73-11411	2J	
Falling-Drop Technique for Silt-Clay Sediment Analysis, W73-11558	5A	
Nutrient Ratio Variation in Reservoir Sediments, W73-11591	5B	
A Quantitative, Semiroutine Method for Determining Algal and Sedimentary Chlorophyll Derivatives, W73-11637	5A	
SEDOSONS		
The Classification of Arid Zone Soils: II. The Classification of Sedosols in South Arabia, W73-11418	2G	
SEEPAGE		
Steady-State Seepage in a Hillside, W73-11212	2G	
SEEPAGE CONTROL		
Hydrogeologic Considerations for Sealing Coal Mines, W73-11675	5G	
SEICHES		
Seismic Seiches in Bays, Channels, and Estuaries, W73-11532	2H	
SEISMIC STUDIES		
Location and Determination of Depths of Sub-surface Undulations by Seismic Methods, W73-11398	8E	
SEISMIC WAVES		
Seismic Seiches in Bays, Channels, and Estuaries, W73-11532	2H	
SELECTIVE ION MONITORING		
Comparison of Selective Ion Monitoring and Repetitive Scanning During Gas Chromatography-Mass Spectrometry, W73-11493	5A	
SELECTIVE MEDIA		
Isolation of Salmonellae from Moderately Polluted Waters, W73-11134	5A	
SELECTIVITY		
Selective Determination of Copper (II) In Aqueous Media by Enhancement of Flash-Photolytically Initiated Riboflavin Chemiluminescence, W73-11636	5A	
SELENIUM		
Oxidation of Copper (II) Selenide by Thiobacillus Ferrooxidans, W73-11171	5C	
SENSITIVITY		
Atomic Absorption Spectrophotometry as a Tool for the Water Chemist, W73-11294	5A	
Comparison of Selective Ion Monitoring and Repetitive Scanning During Gas Chromatography-Mass Spectrometry, W73-11493	5A	
SEWAGE PURIFICATION		
Construction of a Purification Plant for Polluted Water Using Photosynthetic Bacteria, W73-11569	5D	
SEWAGE SLUDGE		
Lead Emissions from Incinerated Sewage Sludge Detected on Tree Foliage, W73-11302	5A	
Development of a Mobile System for Cleaning Oil-Contaminated Beaches, W73-11064	5G	
Solvent Extraction Status Report, W73-11066	5D	
Anion Exchange Separations of the Elements Extractable with Tributyl Phosphate. IV, (Anionenaustausch trennungen der mit Tributylphosphat extrahierbaren Elemente. IV), W73-11122	5A	
Alpha-Al2O3 as an Adsorbent in Thin-Layer Chromatography, W73-11128	5A	
Skimming Device for use on a Liquid Surface, W73-11233	5D	
Recover Zinc From Zinc Ash, W73-11281	5D	
Ultra High Rate Filtration of Activated Sludge Plant Effluent, W73-11337	5D	
A Solvent Extraction Method for the Determination of Phosphorus-32 in Sea Water, W73-11643	5A	
Liquid-Liquid Extraction of Cadmium With High-Molecular-Weight Amines From Iodide Solutions, W73-11664	5A	
SETTLEMENT (STRUCTURAL)		
Numerical Statistics in Engineering Geology, W73-11517	8G	
SETTLING BASINS		
Hydraulic Design of Stilling Basin for Pipe or Channel Outlets, W73-11533	8B	
SETTLING VELOCITY		
Design Factors for Effective Settling of Coagulated Water, W73-11451	5F	
SEWAGE		
A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. V, Jamaica Bay Rainstorms, W73-11351	5B	
SEWAGE DISPOSAL		
Chemical and Biological Quality of Municipal Sludge, W73-11679	5E	
SEWAGE EFFLUENTS		
Impairment of the Flavor of Fish by Water Pollutants, W73-11322	5C	
Petroleum Hydrocarbons and Fatty Acids in Wastewater Effluents, W73-11575	5B	
Nitrogen and Phosphorus Uptake by <i>Chlorella pyrenoidosa</i> in Sewage Treatment Processes, W73-11617	5B	
SEWAGE PURIFICATION		
Construction of a Purification Plant for Polluted Water Using Photosynthetic Bacteria, W73-11569	5D	
SEWAGE SLUDGE		
Lead Emissions from Incinerated Sewage Sludge Detected on Tree Foliage, W73-11302	5A	

SUBJECT INDEX

SEWAGE SLUDGE

Chemical and Biological Quality of Municipal Sludge, W73-11679	5E	SHORE PROTECTION Protection and Control of the Salt Water Shore Area. W73-11114	6E	SLOPE STABILITY An Evaluation of the Utility of Available Remote Sensor Returns for a Study of Slope Failure Phenomena, W73-11216	7B
SEWAGE TREATMENT		SHRIMP DDT, DDE, and Polychlorinated Biphenyls in Biota From the Gulf of Mexico and Caribbean Sea—1971, W73-11580	5B	SLOPES Steady-State Seepage in a Hillside, W73-11212	2G
Activated Sludge Sewage Treatment Process and System, W73-11239	5D	SILICATES Nutrient Inversions in the Southeastern Tropical Pacific Ocean, W73-11587	2L	SLUDGE DISPOSAL Smithsonian Advisory Committee Report on Studies of the Effects of Waste Disposal in the New York Bight, W73-11642	5C
Apparatus for Handling Sewage, W73-11242	5D	SILTS Behaviour of Fine Sands and Silts During the Rise of Ground-Water Level, W73-11194	2G	Leachate Quality from Acidic Mine Spoil Fertilized with Liquid Digested Sewage Sludge, W73-11680	5G
Apparatus for Separating Pollutants and Obtaining Separate Liquids and Solids, W73-11359	5D	Falling-Drop Technique for Silt-Clay Sediment Analysis, W73-11558	5A	SLUDGE TREATMENT Sludge Concentration, W73-11357	5D
Generic Feed Forward Control of Activated Sludge, W73-11362	5D	SILVER The Occurrence and Seasonal Variation of Trace Metals in the Scallops <i>Pecten maximus</i> (L.) and <i>Chlamys opercularis</i> (L.), W73-11624	5A	SLURRY CONCENTRATION Water-Solids Separation in an Upflow: With Particular Reference to Use of a Slurry Pool for Solids Contact in Water Treatment, W73-11313	5F
Petroleum Hydrocarbons and Fatty Acids in Wastewater Effluents, W73-11575	5B	SIMAZINE The Influence of Simazine on the Photosynthetic Pigments of Green Algae, W73-11610	5C	SMALL WATERSHEDS Virginia Small Streams Program, Preliminary Flood-Frequency Relations, W73-11090	2E
Nitrogen and Phosphorus Uptake by Chlorella pyrenoidosa in Sewage Treatment Processes, W73-11617	5B	SIMULATED EVAPORATION Comparison of Simulated and Actual Evaporation From Maize and Soil in a Lysimeter, W73-11201	2D	Watershed Research, W73-11534	2A
Ozonation of Microstrained Secondary Effluent, W73-11678	5D	SIMULATION ANALYSIS Iterative Simulation Algorithm in Reservoir Systems Operation, W73-11139	4A	Investigation of the Dynamics and Calculation of the Losses of Spring Runoff in a Small River Basis (Issledovaniye dinamiki i raschet poter' vesennego stoka v malom rechnom basseyne), W73-11690	2E
SEWERAGE		Qualitative Values in Environmental Planning: A Study of Resource Use in Urbanizing Watersheds, W73-11253	5G	SMELTING Environment, W73-11183	5C
Brown County Sewage and Solid Waste Study - 1972, W73-11250	5E	Generic Feed Forward Control of Activated Sludge, W73-11362	5D	SNAILS The Effects of Temperature on Growth and Reproduction of Aquatic Snails, W73-11444	5C
Comprehensive Water Sewer Plan for Baldwin County, Alabama. W73-11261	5D	River Systems Transition Function and Operation Study, W73-11364	4A	Population Studies of three Aquatic Gastropods in an Intermittent Backwater, W73-11494	5A
Comprehensive Water and Sewer Plan for Escambia County, Alabama. W73-11262	5D	SIXMILE CREEK (CHISMVILLE ARK) Fluvial Sediment in Sixmile Creek Subwatershed 6, Near Chismville, Arkansas, W73-11082	2J	Dursban (Trademark) and Diazinon Residues in Biota Following Treatment of Intertidal Plots on Cape Cod - 1967-69, W73-11627	5C
Public Utilities in Winnebago County. W73-11263	3D	SKIMMING Vacuum Skimming Apparatus for Removing Liquid Contaminants Floating in Confined Bodies of Water, W73-11232	5G	Epidemiological Study on Clondorchis sinensis Around Lake Biwa, Shiga Prefecture: I. Survey on Distribution of <i>Parafossarulus Manchouricus</i> , The First Intermediate Host Snail (In Japanese), W73-11654	2H
Mercury in Public Sewer Systems, W73-11585	5D	Skimming Device for use on a Liquid Surface, W73-11233	5D	SNAKE RIVER Biological Effects of Fluctuating Water Levels in the Snake River, Grand Teton National Park, Wyoming, W73-11594	2E
Comprehensive Regional Water and Sewer Inventory and Analysis, W73-11670	7B	Using Fire Streams With a Self-Propelled Oil Spill Skimmer, W73-11434	5G	On Large Diversions from the Northwest—Normal and High-Flow Years, W73-11685	6A
Reduction of Hydraulic Sewer Loadings by Downspout Removal, W73-11671	4A	A Small Vacuum Oil Skimming System, W73-11436	5G	SNOW Lead Contamination of Snow, W73-11275	5B
SEWERS		SLAUGHTERHOUSE WASTES Occurrence of Salmonella in Oxidation Ditches, W73-11136	5A		
Least Cost Method for Sewer Design, W73-11360	5G				
MSB Computerized Combined Sewer Control System, W73-11673	5G				
SHAPE					
Problem of the Influence of Shape of Channel Cross Section on Velocity Distribution in a Uniform Turbulent Flow (K voprosu o vliyanii formy secheniya russia na raspredeleniye skorostey v ravnnomernom turbulentnom potokе), W73-11408	8B				
SHOALS					
A Case History of Santa Cruz Harbor, California, W73-11092	8B				
Hydraulic Model Measurements of Tidal Currents Around Cape Henlopen, Delaware, W73-11203	2L				

SUBJECT INDEX

SOILS

Crude Oil Behavior on Arctic Winter Ice,		
W73-11539	5B	
SNOWMELT		
Investigation of the Dynamics and Calculation of the Losses of Spring Runoff in a Small River Basin (Issledovaniye dinamiki i raschet poter' vesennyego stoka v malom rechnom basseyne),		
W73-11690	2E	
SNOWY MOUNTAINS REGION (AUSTRALIA)		
Sediment Records of the Snowy Mountains Re- gion, Australia.		
W73-11572	2J	
SOAPs		
Phosphorus in Waste Water,		
W73-11592	5D	
SOCIAL ASPECTS		
Economic Growth and Environmental Impact: Evaluating Alternatives,		
W73-11511	6B	
SOCKEYE SALMON		
Effects of Sublethal Concentrations of Sodium Pentachlorophenate on Growth Rate, Food Conversion Efficiency, and Swimming Per- formance in Underyearling Sockeye Salmon (<i>Oncorhynchus nerka</i>),		
W73-11656	5C	
SODIUM NITRILOTRIACETATE		
Survival and Gill Condition of Bluegill (<i>Lepomis macrochirus</i>) and Fathead Minnows (<i>Pimephales promelas</i>) Exposed to Sodium Nitrilocetate (NTA) for 28 Days,		
W73-11621	5C	
SODIUM PENTACHLOROPHENATE		
Effects of Sublethal Concentrations of Sodium Pentachlorophenate on Growth Rate, Food Conversion Efficiency, and Swimming Per- formance in Underyearling Sockeye Salmon (<i>Oncorhynchus nerka</i>),		
W73-11656	5C	
SODIUM SULFATE		
Fallout of Sodium Sulphate near a Kraft Mill,		
W73-11175	5A	
SODIUM WATERS		
Short-Term Effects of Irrigation with High Sodium Waters,		
W73-11111	3C	
SOIL BACTERIA		
Iron Bacteria-A Likely Subject of Co-Or- derated Research,		
W73-11471	5B	
SOIL CHEMISTRY		
External Corrosion of Buried Ferrous Pipelines/1,		
W73-11467	8G	
SOIL CLASSIFICATION		
The Classification of Arid Zone Soils: I. An Approach to the Classification of Arid Zone Soils Using Depositional Features,		
W73-11417	2G	
The Classification of Arid Zone Soils: II. The Classification of Sedosols in South Arabia,		
W73-11418	2G	
SOIL COMPACTION		
Fertilizer Response to the Physical Effects of Soil Compaction,		
W73-11280	3F	
SOIL CONTAMINATION		
Incidence of Mercury in Illinois Pheasants,		
W73-11305	5A	
SOIL EROSION		
Effect of Soil, Cover, Slope, and Rainfall Fac- tors on Soil and Phosphorus Movement Under Simulated Rainfall Conditions,		
W73-11208	5B	
Phosphorus Losses From Four Agricultural Watersheds on Missouri Valley Loess,		
W73-11209	5B	
SOIL LIQUEFACTION		
Behaviour of Fine Sands and Silts During the Rise of Ground-Water Level,		
W73-11194	2G	
SOIL MATRIC POTENTIAL		
Response of Relative Water Content in Zea Mays L. to Changes of Potential in the Rhizo- sphere and Atmosphere,		
W73-11145	3F	
SOIL MECHANICS		
Behaviour of Fine Sands and Silts During the Rise of Ground-Water Level,		
W73-11194	2G	
Relationships Between Volume and Pore-Water Change and Shear Stress in Granular Soils,		
W73-11197	2G	
Behaviour of Transition Soils Under the Effect of Water,		
W73-11198	2G	
SOIL MOISTURE		
A New Method for the Soil Moisture Measure- ment (Momim's Method),		
W73-11117	2G	
Behaviour of Transition Soils Under the Effect of Water,		
W73-11198	2G	
Capillary-Diffusion and Self-Diffusion of Liquid Water in Unsaturated Soils,		
W73-11390	2G	
The Response of Native Montana Grasses to Soil Water Stress,		
W73-11429	2I	
Relationships between Moisture Retention and Particle Size Distribution of the Soil,		
W73-11634	2G	
SOIL MOISTURE METERS		
A New Method for the Soil Moisture Measure- ment (Momim's Method),		
W73-11117	2G	
SOIL MORPHOMETRY		
Relationships Between Saturated Hydraulic Conductivity and Morphometric Data of an Ar- gillic Horizon,		
W73-11211	2G	
SOIL PARTICLE SIZE		
Relationships between Moisture Retention and Particle Size Distribution of the Soil,		
W73-11634	2G	
SOIL PHYSICAL PROPERTIES		
Pore Pressure Measurements in Aelotropic Peat,		
W73-11195	2G	
SOIL POLLUTION		
Heavy Metals: Fallout Around a Power Plant,		
W73-11282	5A	
SOIL SEALANTS		
Hydrogeologic Considerations for Sealing Coal Mines,		
W73-11675	5G	
SOIL STRENGTH		
Influence of Weathering on Effective Values of Shear Strength of Miocene Clay,		
W73-11196	2K	
Behaviour of Transition Soils Under the Effect of Water,		
W73-11198	2G	
SOIL TEMPERATURE		
Analysis of Soil Temperatures in the Arid Zone of India by Fourier Techniques,		
W73-11177	2G	
SOIL TESTS		
Pore Pressure Measurements in Aelotropic Peat,		
W73-11195	2G	
Relationships Between Volume and Pore-Water Change and Shear Stress in Granular Soils,		
W73-11197	2G	
Expansion of Cylindrical Probes in Cohesive Soils,		
W73-11520	8D	
SOIL WATER		
Retention and Release of Soil Water as Related to Mineralogy of the Soil Clays,		
W73-11256	2G	
The Response of Native Montana Grasses to Soil Water Stress,		
W73-11429	2I	
SOIL WATER MOVEMENT		
Moisture Transfer and Frost Heave in Loams,		
W73-11193	2G	
Use of Physical Methods to Expand Soil Sur- vey Interpretations of Soil Drainage Condi- tions,		
W73-11210	2G	
Relationships Between Saturated Hydraulic Conductivity and Morphometric Data of an Ar- gillic Horizon,		
W73-11211	2G	
Steady-State Seepage in a Hillside,		
W73-11212	2G	
SOILS		
Morphology and Distribution of Soils of Lower Ib Watershed,		
W73-11258	2G	
Lithium in Surficial Materials of the Conti- nous United States and Partial Data on Cad- mium,		
W73-11268	5B	
Measurement of Contact Angle of Water in Soils and Sand,		
W73-11273	2G	
Lead Pollution from a Factory Manufacturing Anti-Knock Compounds,		
W73-11290	3B	
Determination of Trace Mercury in Soil and Rock Media,		
W73-11297	5A	
Highly Resistant Copper Deteriorates in Severely Corrosive Soils,		
W73-11454	8G	

SUBJECT INDEX

SOILS (ARID ZONE)

SOILS (ARID ZONE)
The Classification of Arid Zone Soils: I. An Approach to the Classification of Arid Zone Soils Using Depositional Features, W73-11417 2G

The Classification of Arid Zone Soils: II. The Classification of Sedosols in South Arabia, W73-11418 2G

SOILS (FOREST)

Investigation on Erodibility and Water Stable Aggregates of Certain Soils of Eastern Nepal, W73-11272 2J

SOLID WASTES

Brown County Sewage and Solid Waste Study - 1972, W73-11250 5E

System Study for Surveillance of Ocean Dumping Operations, W73-11573 5B

SOLUBILITY

Organic Materials in the Marine Environment and the Associated Metallic Elements, W73-11184 5B

SOLUTES

Salt and Nonelectrolyte Interactions in Water, W73-11166 1B

SOLVENT EXTRACTIONS

Solvent Extraction Status Report, W73-11066 5D

Anion Exchange Separations of the Elements Extractable with Tributyl Phosphate. IV, (Anionenaustausch trennungen der Mit Tributylphosphat Extrahierbaren Elemente. IV), W73-11122 5A

The Determination of Small Amounts of Mercury in Organic Matter, W73-11296 5A

SORBENT-OIL RECOVERY SYSTEM

Development and Preliminary Design of a Sorbent-Oil Recovery System, W73-11071 5G

SORGHUM-BICOLOR-M

The Origin and Domestication of Sorghum Bicolor, W73-11561 3F

SORPTION

Removal of Oil From Water Surfaces By Sorption on Unstructured Fibers, W73-11586 5G

SOURIS RIVER BASIN (N. DAK)

Water Quality Investigations: Souris River Basin, North Dakota, 1969, W73-11115 5B

SOUTH AFRICA

The Effect of Afforestation on Streamflow at Cathedral Peak: Report No. 1, W73-11310 4C

SOUTH DAKOTA

Flood of June 9-10, 1972, at Rapid City, South Dakota, W73-11105 7C

SOUTHWEST US

Nuclear Dual Purpose Plants in Regional Development, W73-11496 3A

SOYBEAN-D NODULES

The Effects of Water Stress on Nitrogen-fixing Root Nodules: II. Effects of the Fine Structure of Detached Soybean Nodules, W73-11415 3F

SOYBEAN-D ROOTS

The Effects of Water Stress on Nitrogen-fixing Root Nodules: III. Effects of Osmotically Applied Stress, W73-11416 3F

SPECIATION

A New Crayfish of the Subgenus *Jugicambarus* from Tennessee with an Emended Definition of the Subgenus (*Astacidae, Decapoda*), W73-11590 5A

SPECIES DIVERSITY

Study of the Changes in the Structure of Two Algal Populations: An R-Type Factor Analysis, W73-11129 5A

Spring Phytoplankton Abundance and Productivity in Grand Traverse Bay, Lake Michigan, 1970, W73-11629 5B

SPECIFIC YIELD

Efficiency of Well Screens and Gravel Packs: Final Report of Research Panel, No 6, W73-11474 8D

SPECTROPHOTOMETRY

Volatilization of Mercuric Chloride by Mercury-Resistant Plasmid-Bearing Strains of *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*, W73-11286 5B

Determination of Total Chromium in Fresh Waters by Atomic Absorption, W73-11295 5A

The Determination of Small Amounts of Mercury in Organic Matter, W73-11296 5A

Trace Metal Content of Hair, I. Zinc and copper Content of Human Hair in Relation to Age and Sex, W73-11308 5A

Determination of Carbohydrate in Lake Sediment by a Modified Phenol-Sulfuric Acid Method, W73-11482 5A

Spectrophotometric Method for Determination of Ozone in Aqueous Solutions, W73-11495 5A

SPECTROSCOPY

Applications of Multispectral Remote Sensing Techniques to Hydrobiological Investigations In Everglades National Park, W73-11553 7B

SPILLS

Control of Hazardous Chemical Spills by Physical Barriers, W73-11338 5G

SPONTANEOUS POTENTIAL

Typical Log-Curve Shapes Indicate Formation Characteristics, W73-11456 8A

SPRAY FREEZER

Spray Freezing, Decanting, Melting and Hydrolysis as Related to Secondary Refrigerant Desalting, W73-11158 3A

SPRING

Investigation of the Dynamics and Calculation of the Losses of Spring Runoff in a Small River Basin (Issledovaniye dinamiki i raschet poteri vesennego stoka v malom rechnom basseyne), W73-11690 2E

SPRINKLER IRRIGATION

Water Infiltration Under Center-Pivot Sprinklers, W73-11514 8B

Wastewater Management Through Land Utilization - Muskegan County, Michigan, USA, W73-11515 5D

Financing Private Water Resource Development: Analysis of a State Loan Program, W73-11686 3F

ST. LAWRENCE RIVER

Investigation of Infrared Anomalies in the Lac Des Deux Montagnes Area, Quebec, W73-11541 7B

STANDARD ADDITION POTENTIOMETRY

Copper Determination in Water by Standard Addition Potentiometry, W73-11605 5A

STANDING CROPS

Population Studies of three Aquatic Gastropods in an Intermittent Backwater, W73-11494 5A

Spring Phytoplankton Abundance and Productivity in Grand Traverse Bay, Lake Michigan, 1970, W73-11629 5B

STATE LOAN PROGRAMS

Financing Private Water Resource Development: Analysis of a State Loan Program, W73-11686 3F

STATISTICAL METHODS

Nonlinear Parameter Estimation in Water Quality Modeling, W73-11361 5B

Procedure Improved for Determining Corrosion Rate by Weight Loss, W73-11478 8G

Supplementation of Missing Values in Water Quality Data, W73-11687 5G

STATISTICS

Trace Metal Content of Hair, I. Zinc and copper Content of Human Hair in Relation to Age and Sex, W73-11308 5A

Numerical Statistics in Engineering Geology, W73-11517 8G

STEADY-STATE CHEMISTRY

The Chemical Stability of the Oceans and the CO₂ System, W73-11374 2K

SUBJECT INDEX

SULFUR

STEAM STRIPPING	STRATIFICATION				STRUCTURAL BEHAVIOR
Steam Stripping Odorous Substances from Kraft Effluent Streams (SEKOR), W73-11060	Circulation Patterns in Lake Superior, W73-11342				A Probabilistic Approach to Maximum Column Strength, W73-11516
5D	2H				8A
STEEL FIBERS	STRATIFIED FLOW				STRUCTURAL STEEL
Flexural Fatigue Strength of Steel Fiber Reinforced Concrete Beams, W73-11498	Simultaneous, Multiple-Level Release from Stratified Reservoirs, W73-11567				Design, Structural Details, and Discontinuities in Steel, W73-11524
8F	8B				8G
STEEL PIPES	STREAMBEDS				STUDY DESIGN
Cement Mortar Lining of 20-Ft Diameter Steel Pipe, W73-11522	Application of Regression Analysis to the Study of Background Variations in Trace Metal Content of Stream Sediments, W73-11179				Regional Waste Water, Solid Waste Disposal, Water Supply, and Storm Drainage Systems Appraisal, W73-11252
8F	5A				5G
Determining the Strength of Corroded Pipe, W73-11527	Inflow to Rivers in the Pamirs (Pitaniye rek Pamira), W73-11096				SUBMERGED SILLS
8G	2C				Effects of Submerged Sills in the St. Clair River, W73-11089
STEEL STRUCTURES	STREAMFLOW				8B
All-Position Production Welding with Flux-Cored Gas-Shielded Electrodes, W73-11501	A Study of the Flint River, Michigan, as it Relates to Low-Flow Augmentation, W73-11207				SUBSIDENCE
8C	5G				Wetting Requirements to Improve Collapsing Foundation Soils, W73-11526
Designing to Prevent Brittle Fractures in Bridges, W73-11525	Water Records of the U.S. Virgin Islands, 1962-69, W73-11396				8D
8G	2E				
STEELHEAD TROUT	STREAMFLOW FORECASTING				SUBSTRATES
Development of Dissolved Oxygen Criteria for Freshwater Fish, W73-11327	Probabilistic Short-Term River Yield Forecasts, W73-11366				A Colorimetric Technique Suggested for Chemical Oxygen Demand Determination, W73-11599
5C	4A				5A
STOCHASTIC PROCESSES	STREAMS				SUBSURFACE INVESTIGATIONS
Disaggregation Processes in Stochastic Hydrology, W73-11141	Mathematical Methods in the Theory and Practice of Mountain Streamflow Computation and Forecasting (Matematicheskiye metody v teorii i praktike raschetov i prognozov stoka gornykh rek), W73-11406				Location and Determination of Depths of Subsurface Undulations by Seismic Methods, W73-11398
2E	4A				8E
Stochastic Reservoir Management and System Design for Irrigation, W73-11152	Water Quality Investigations: Souris River Basin, North Dakota, 1969, W73-11115				
3F	5B				
Probabilistic Short-Term River Yield Forecasts, W73-11366	Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri, W73-11271				
4A	5C				
STOICHIOMETRY	The Freshwater Stream, A Complex Ecosystem, W73-11389				
Determination of Phenols and Aromatic Amines by Direct Titration with Bromine in Propylene Carbonate, W73-11485	6G				
5A					
STONEFLIES	Effects of Logging on Periphyton in Coastal Streams of Oregon, W73-11582				
Biological Effects of Fluctuating Water Levels in the Snake River, Grand Teton National Park, Wyoming, W73-11594	5C				
2E					
STORM RUNOFF	Enumeration and Differentiation of Water Bacteria with Phosphorus-32, W73-11133				
A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. V, Jamaica Bay Rainstorms, W73-11351	5A				
5B					
Urban Hydrology for the Period Up to December 1971. W73-11698	Simplified Computer Approach to the Ultimate Load Analysis and Design of Reinforced Concrete Frames, W73-11499				
4C	8F				
STORM SEWERS	STREPTOCOCCUS FAECALIS				
Comprehensive Water Sewer Plan for Baldwin County, Alabama. W73-11261	Torsional Stiffness of Reinforced Concrete Members Subjected to Pure Torsion, W73-11519				
5D	8F				
Comprehensive Water and Sewer Plan for Escambia County, Alabama. W73-11262	A Probabilistic Approach to Maximum Column Strength, W73-11516				
5D	8A				
STORM SURGE	STRUCTURAL ANALYSIS				
A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. V, Jamaica Bay Rainstorms, W73-11351	Sulfate Reduction, Pyrite Formation, and the Oceanic Sulfur Budget, W73-11386				
5B	5B				
	Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection, W73-11606				
	5A				

SUBJECT INDEX

SULFUR COMPOUNDS

SULFUR COMPOUNDS	
Oxidation of Pyrites in Chlorinated Solvents, W73-11068	5D
Environment, W73-11183	5C
Low pH Values Shown to Affect Developing Fish Eggs (<i>Brachydanio rerio Ham.-Buch.</i>), W73-11651	5C
SUMMIT LAKE (B C)	
Drainings of Ice-Dammed Summit Lake, British Columbia, W73-11547	2E
SUPPLEMENTARY TREATMENT	
Ozone for Supplementary Water Treatment, W73-11677	5F
SURFACE-GROUNDWATER RELATIONSHIPS	
Stream Depletion Factors, Arkansas River Valley, Southeastern Colorado: A Basis for Evaluating Plans for Conjunctive Use of Ground and Surface Water, W73-11221	4B
Investigation of Infrared Anomalies in the Lac Des Deux Montagnes Area, Quebec, W73-11541	7B
Electrical-Analog Model Study of a Hydrologic System in Southeast Florida, W73-11570	2A
SURFACE WATERS	
Water Resources Data for Alabama, 1970: Part 2. Water Quality Records, W73-11085	2K
Tritium Concentration of a Variety of Water Samples: Fifth Listing, W73-11104	5B
Leaf Processing in a Woodland Trout Stream, W73-11112	5B
Industrial Waste Survey, Dade County, Florida, W73-11217	5B
Water Resources of Hempstead, Lafayette, Little River, Miller, and Nevada Counties, Arkansas, W73-11222	4B
The Use of Atomic Absorption for Analysis of Natural Waters, W73-11291	5A
Hydrologic Records for Volusia County, Florida: 1971-72, W73-11399	7C
Ice Forces on Vertical Piles, W73-11538	8B
Water Resources Inventory of Connecticut: Part 6. Upper Housatonic River Basin, W73-11555	2A
Organochlorine Insecticides in Surface Waters in Germany-1970 and 1971, W73-11628	5C
Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering, W73-11631	5A

SURFICIAL MATERIALS

Lithium in Surficial Materials of the Contiguous United States and Partial Data on Cadmium, W73-11268	5B
---	----

SURVEYING

Computer Program System for Aerotriangulation, W73-11518	7C
--	----

SURVEYS

Principles of Landslide Identification from Aerial Survey Data (Printsyi raspoznavaniya opolznevnykh protsessov po materialam aerofotos'yemki), W73-11100	2J
---	----

An Individual Approach to Independent Computer Survey, W73-11512	7C
--	----

Progress Report on Water Quality of Lake Michigan Near Chicago, W73-11581	5B
---	----

SURVIVAL

Population Studies of three Aquatic Gastropods in an Intermittent Backwater, W73-11494	5A
--	----

Low pH Values Shown to Affect Developing Fish Eggs (<i>Brachydanio rerio Ham.-Buch.</i>), W73-11651	5C
---	----

SUSPENDED LOAD

An Inventory of Suspended Sediment Stations and Type of Data Analysis for Pennsylvania Streams, 1947-70, W73-11083	2J
--	----

SUSPENDED SOLIDS

Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material, W73-11339	5A
--	----

Organochlorine Insecticides in Surface Waters in Germany-1970 and 1971, W73-11628	5C
---	----

SYNOPTIC ANALYSIS

Large-Scale and Long-Term Fluctuations in some Atmospheric and Oceanic Variables, W73-11369	2B
---	----

SYNTHESIS

2,4,6-Triphenylpyrlylum Chloride. A New Organic Analytical Reagent for the Determination of Certain Anions, W73-11623	5A
---	----

SYSTEMS ANALYSIS

Qualitative Values in Environmental Planning: A Study of Resource Use in Urbanizing Watersheds, W73-11253	5G
---	----

TANNERY WASTES

Secondary Waste Treatment for a Small Diversified Tannery, W73-11340	5D
--	----

TAPERED STEEL POLES

All-Position Production Welding with Flux-Cored Gas-Shielded Electrodes, W73-11501	8C
--	----

TASTE

Taste and Odor Control in Water, W73-11318	5F
--	----

Impairment of the Flavor of Fish by Water Pollutants, W73-11322	5C
---	----

Taste and Odor Control - Chemicals and Methods, W73-11421	5F
---	----

TECHNICAL SOCIETIES

Information on Activities of the Commission on Surface Waters of the International Association of Scientific Hydrology (IASH) (Informatsiya o rabote komissii poverkhnostnykh vod Mezhdunarodnoy assotsiatsii nauchnoy hidrologii (MANG)), W73-11414	2A
--	----

TECHNOLOGY

New Down-Hole Tools Improve Drilling, W73-11458	8B
---	----

TEMPERATURE

Freeze-Free (32 F) Seasons of the Major Basins and Plateaus of Nevada, W73-11218	7C
--	----

Environmental Effects on Toxaphene Toxicity to Selected Fishes and Crustaceans, W73-11323	5C
---	----

TEMPERATURE GRADIENT

Reverse Osmosis Water Purifying System with Gradient Barrier Water Storage Container, W73-11356	3A
---	----

TEMPORAL DISTRIBUTION

Water Quality Models for Total Coliform, W73-11135	5B
--	----

TENNESSEE

Physical Erosion and Denudation Rates in Cartwright Basin and Vicinity, Williamson County, Tennessee, W73-11140	2J
---	----

TERBACIL

Movement of Acarol and Terbicil Pesticides During Displacement Through Columns of Wabasso Fine Sand, W73-11537	5B
--	----

TERTIARY TREATMENT

Tertiary Filtering Arrangement, W73-11241	5D
---	----

Ultra High Rate Filtration of Activated Sludge Plant Effluent, W73-11337	5D
--	----

Ozonation of Microstrained Secondary Effluent, W73-11678	5D
--	----

TESTING

Standard Dispersant Effectiveness and Toxicity Tests, W73-11442	5A
---	----

TESTING PROCEDURES

A Continuous-Flow Apparatus for Assessing the Toxicity of Substances to Marine Animals, W73-11169	5C
---	----

TEXAS

Coastal Dynamics along Mustang Island, Texas, W73-11081	2L
---	----

Annual Compilation and Analysis of Hydrologic Data for Urban Studies in the Fort Worth, Texas, Metropolitan Area, 1971, W73-11215	4C
---	----

SUBJECT INDEX

TRACE ELEMENTS

TEXTILE FINISHING WASTES		TIDAL MARSHES	
Dyestuff Color Removal by Ionizing Radiation and Chemical Oxidation, W73-11329	5D	Living Foraminiferids of Tidal Marshes: A Review, W73-11502	2L
TEXTILES		TIDAL WATERS	
A Study of the Photodegradation of Commercial Dyes, W73-11325	5B	Volume Transport, Salinity Distribution and Net Circulation in the Duplin Estuary, Georgia, W73-11425	2L
THALLIUM		TIME SERIES ANALYSIS	
Anodic Stripping Voltammetry at a Tubular Mercury-Covered Graphite Electrode, W73-11484	5A	Disaggregation Processes in Stochastic Hydrology, W73-11141	2E
THERMAL POLLUTION		TOMS RUN	
Analysis of Engineering Alternatives for Environmental Protection from Thermal Discharges. W73-11078	5G	The Need for Hydrogeologic Evaluations in a Mine Drainage Abatement Program: A Case Study, Toms Run, Clarion County, Pennsylvania, W73-11674	5G
Numerical Thermal Plume Model for Vertical Outfalls in Shallow Water, W73-11333	5B	TOPOGRAPHIC MAPPING	
Some Thermal Consequences of Environmental Manipulations of Water, W73-11355	5C	An Individual Approach to Independent Computer Survey, W73-11512	7C
Combined Effect of Thermal and Organic Pollution on Oxygen Sag Curve, W73-11423	5C	TORONTO (ONTARIO)	
The Effects of Temperature on Growth and Reproduction of Aquatic Snails, W73-11444	5C	Systems Approach to Training and Licensing of Water Works Personnel in Ontario, W73-11676	5F
THERMAL POWERPLANTS		TOXAPHENE SALINITY	
Analysis of Engineering Alternatives for Environmental Protection from Thermal Discharges. W73-11078	5G	Environmental Effects on Toxaphene Toxicity to Selected Fishes and Crustaceans, W73-11323	5C
Thermal Stress		TOXIC CHEMICALS HANDBOOK	
Effects of Logging on Growth of Juvenile Coho Salmon, W73-11433	5C	Handbook of Toxic Chemicals (Second Edition, Revised and Supplemented), W73-11554	5C
THESAURI		TOXICITY	
Environmental Terminology Index. W73-11387	10C	Effects of Chemical Variations in Aquatic Environments: Volume II, Toxic effects of aqueous aluminum to rainbow trout, W73-11075	5C
THIN LAYER CHROMATOGRAPHY		Effects of Chemical Variations in Aquatic Environments: Volume III, Lead Toxicity to Rainbow Trout and Testing Application Factor Concept, W73-11076	5C
Alpha-Al203 as an Adsorbent in Thin-Layer Chromatography, W73-11128	5A	A Continuous-Flow Apparatus for Assessing the Toxicity of Substances to Marine Animals, W73-11169	5C
A Simple Microscale Vacuum Collector for the Elution of Closely Situated Spots from Thin-Layer Chromatograms, W73-11657	5A	Acute Zinc Toxicity to Rainbow Trout (<i>Salmo gairdneri</i>): Confirmation of the Hypothesis that Death is Related to Tissue Hypoxia, W73-11180	5C
THIOBACILLUS FERROOXIDANS		Toxic Effects of Trace Elements on the Reproduction of Mice and Rats, W73-11190	5C
Oxidation of Copper (II) Selenide by <i>Thiobacillus Ferrooxidans</i> , W73-11171	5C	Prague International Lead Panel: Effects of Atmospheric Lead on Biological Systems, W73-11265	5C
THYRISTORS		Metal Toxicity to Sewage Organisms, A Discussion, W73-11266	5D
Solution of Problems on Interconnected AC Systems by Means of HVDC Transmission Systems, W73-11521	8C	Lead Accumulation Within Nuclei of Moss Leaf Cells, W73-11276	5E
TIDAL EFFECTS		Sea Fish Contamination With Mercury (Contamination des poissons de mer par le mercure), W73-11289	5C
Measurement of Salt-Wedge Excursion Distance in the Duwamish River Estuary, Seattle, Washington, by Means of the Dissolved-Oxygen Gradient, W73-11564	5B	The Case Against Mercury, W73-11303	5C
		Trace Elements in the Human Environment, W73-11304	5B
		Standard Dispersant Effectiveness and Toxicity Tests, W73-11442	5A
		A Cyprinodont Fish, <i>Jordanella floridae</i> , as a Laboratory Animal for Rapid Chronic Bioassays, W73-11598	5C
		Sublethal Effects of Bleached Kraft Pulp Mill Effluent on Respiration and Circulation in Sockeye Salmon (<i>Oncorhynchus nerka</i>), W73-11615	5C
		Copper Induced Lesions in Estuarine Teleosts, W73-11616	5C
		Survival and Gill Condition of Bluegill (<i>Lepomis macrochirus</i>) and Fathead Minnows (<i>Pimephales promelas</i>) Exposed to Sodium Nitritoacetate (NTA) for 28 Days, W73-11621	5C
		Identification of the Constituents of Kraft Pulping Effluent That are Toxic to Juvenile Coho Salmon (<i>Oncorhynchus kisutch</i>), W73-11638	5A
		Small-Scale Experiments to Determine the Effects of Crude Oil Films on Gas Exchange Over the Coral Back-Reef at Heron Island, W73-11650	5C
		Temperature Effects on Mercury Accumulation, Toxicity, and Metabolic Rate in Rainbow Trout (<i>Salmo gairdneri</i>), W73-11655	5C
		TOXINS	
		Certain Biological Effects of Lead Upon the Animal Organism, W73-11307	5C
		Handbook of Toxic Chemicals (Second Edition, Revised and Supplemented), W73-11554	5C
		TRACE ELEMENTS	
		Neutron Activation Analysis of Bottom Sediments, W73-11067	5A
		Organic Materials in the Marine Environment and the Associated Metallic Elements, W73-11184	5B
		Toxic Effects of Trace Elements on the Reproduction of Mice and Rats, W73-11190	5C
		Diurnal Variation of Aerosol Trace Element Concentrations in Livermore, California, W73-11277	5B
		Areawide Trace Metal Concentrations Measured by Multielement Neutron Activation Analysis - A One Day Study in Northwest Indiana, W73-11278	5B

SUBJECT INDEX

TRACE ELEMENTS

Sea Fish Contamination With Mercury (Contamination des poissons de mer par le mercure), W73-11289	5C
Trace Elements in the Atmospheric Environment, W73-11299	5A
Trace Elements in the Human Environment, W73-11304	5B
Manganese Nodules and Budget of Trace Solubles in Oceans, W73-11384	5B
Role of Iron Sulfides in the Accumulation of Trace Elements in Black Sea Sediments (Rol'sulfidov zheleza pri nakoplenii mikroelementov v osadkakh Chernogo morya), W73-11409	2J
Distribution of Trace Elements in Bodies of Water of Kazakhstan (Raspredeleniye mikroelementov v vodoyemakh Kazakhstana), W73-11413	2K
Ultrapurity in Trace Analysis, W73-11483	5A
TRACE LEVELS	
Copper Determination in Water by Standard Addition Potentiometry, W73-11605	5A
TRACERS	
A Small Dimension Probe for the Determination of Ground Water Flow Direction, W73-11200	2F
The Use of Modern Chromium Accumulations to Determine Estuarine Sedimentation Rates, W73-11392	2L
TRACKING TECHNIQUES	
System Study for Surveillance of Ocean Dumping Operations. W73-11573	5B
TRAINING	
Systems Approach to Training and Licensing of Water Works Personnel in Ontario, W73-11676	5F
TRANSMISSION LINES	
Report of the United States Delegation Visit to the Soviet Union: July 24 to August 6, 1972, W73-11508	8C
TRANSMISSION TOWERS	
All-Position Production Welding with Flux-Cored Gas-Shielded Electrodes, W73-11501	8C
TRANSPARENCY	
Planktonic Changes Following the Restoration of Lake Trumen, Sweden, W73-11639	5G
TRANSPORT	
Cycling of Elements of Estuaries, W73-11645	5B
TRANSPORTATION	
Mobile Area Water Transportation Study of Baldwin, Baldwin and Escambia Counties, Alabama. W73-11260	8A
TRAP EFFICIENCY	
Fluvial Sediment in Sixmile Creek Subwatershed 6, Near Chismville, Arkansas, W73-11082	2J

TRAVEL TIME	
Experiment in the Use of Digital Computers to Determine Traveltime on a Tributary Reach of A River (Opty ispol'zovaniya ETsVM pri opredelenii vremeni dobeganiya na pritochnom uchastke reki), W73-11692	2E
TREATMENT	
Multilevel Control of Multipollutant System, W73-11363	5G
TREATMENT COSTS	
Economic Feasibility of Minimum Industrial Waste Load Discharge Requirements, W73-11335	5D
TREATMENT FACILITIES	
Liquid Sampling, W73-11235	7B
A Dynamic programming approach for Investment Strategies in Wastewater Treatment Plants, W73-11426	5D
TRIANGLE LAKE (OREGON)	
Computer Simulation of Eutrophication, W73-11051	5C
TRIAZINE PESTICIDES	
The Influence of Simazine on the Photosynthetic Pigments of Green Algae, W73-11610	5C
TRIBUTARIES	
Experiment in the Use of Digital Computers to Determine Traveltime on a Tributary Reach of A River (Opty ispol'zovaniya ETsVM pri opredelenii vremeni dobeganiya na pritochnom uchastke reki), W73-11692	2E
TRICKLE IRRIGATION	
Crop Response to Trickling and Subsurface Irrigation, W73-11513	3F
TRITIATED WATER	
Metabolism of Tritiated Water in the Dairy Cow, W73-11186	5B
TRITIUM	
Tritium Concentration of a Variety of Water Samples: Fifth Listing, W73-11104	5B
The Environmental Tritium Concentration of Underground Water and Its Hydrological Interpretation, W73-11544	2F
TROPHIC LEVEL	
Mercury-A Case Study of Marine Pollution, W73-11375	5B
Tropical Role of Bacteria in the Ecosystem of the Coral Reef, W73-11632	5A
TROPICAL REGIONS	
Corrosion of Metals in Tropical Environments—Copper and Wrought Copper Alloys, W73-11455	8G
TROUT HATCHERY	
Pollution as a Result of Fish Cultural Activities, W73-11077	5B
TRUCKEE MEADOWS (NEV)	
Hydrology of Truckee Meadows, Nevada, W73-11430	4B
TSUNAMIS	
The Use of Ocean Tide Records to Detect Motions Premonitory to a Tectonic Event in the Long Beach, California Area, W73-11214	7B
TUBES	
Tube Identifier, W73-11155	3A
TUJUNGA WASH (CALIF)	
Scour and Fill in Tujunga Wash—A Fanhead Valley in Urban Southern California—1969, W73-11350	2J
TUNGSTEN CARBIDE INSERTS	
New Bits Can Drill More Hole, W73-11457	8B
TUNNEL LININGS	
Cement Mortar Lining of 20-Ft Diameter Steel Pipe, W73-11522	8F
TUNNEL SUPPORTS	
Cement Mortar Lining of 20-Ft Diameter Steel Pipe, W73-11522	8F
TUNNELING	
Construction Difficulty Index for Tunnel Construction, W73-11681	8H
TUNNELS	
Construction Difficulty Index for Tunnel Construction, W73-11681	8H
TURBIDITY	
Distribution of Average Turbidity of Rivers in the Armenian SSR (Raspredeleniye sredneye mutnosti rek po territorii Armysanskoy SSR), W73-11099	2E
TURBULENCE	
Water Quality Models for Total Coliform, W73-11135	5B
Sediment Records of the Snowy Mountains Region, Australia. W73-11572	2J
60-MGD Microstraining Plant Meets Denver's Growing Needs, W73-11667	5F
TURBINES	
Rotary Rig Due for Face-Lifting, W73-11459	8B
TURBULENT DIFFUSION	
Radiation, Evaporation and the Maintenance of Turbulence under Stable Conditions in the Lower Atmosphere, W73-11343	2D
A Power Wind Law for Turbulent Transfer Computations, W73-11344	2D
Computing Evapotranspiration by Geostrophic Drag Concept, W73-11345	2D

SUBJECT INDEX

UTAH LAKE

Unified Formulation of Wall Turbulence, W73-11346	2D	URANIUM-MILL EFFLUENT Disposal of Uranium-Mill Effluent by Well Injection in the Grants Area, Valencia County, New Mexico, W73-11551	5E	Mezhdunarodnoy assotsiatii nauchnoy gidrologii (MANG)), W73-11414	2A
Sensitivity of the Solution for Heat Flux or Evaporation to Off-Diagonal Turbulent Diffusivities, W73-11347	2D	URBAN HYDROLOGY Annual Compilation and Analysis of Hydrologic Data for Urban Studies in the Fort Worth, Texas, Metropolitan Area, 1971, W73-11215	4C	USSR (ALTAY MOUNTAINS) Investigation of Seasonal Variability of Runoff on Rivers in the Altay and Sayan Mountain Systems (Issledovaniye vnutrigodovoy neravnomernosti stoka rek Altaya i Sayan), W73-11101	2E
Perturbation Solution of an Equation of Atmospheric Turbulent Diffusion, W73-11348	2D	Effects of Urbanization on Floods in the Houston, Texas, Metropolitan Area, W73-11402	4C	USSR (ARMENIAN SSR) Distribution of Average Turbidity of Rivers in the Armenian SSR (Raspredeleniye sredney mutnosti rek po territorii Armyanskoy SSR), W73-11099	2E
A Solution for Simultaneous Turbulent Heat and Vapor Transfer between a Water Surface and the Atmosphere, W73-11349	2D	Scour and Fill in Tujunga Wash—A Fanhead Valley in Urban Southern California—1969, W73-11550	2J	USSR (BUKHARA OBLAST) Groundwater Regime in the Zone of Influence of Pumping (Rezhim gruntyvkh vod v zone vliyaniya vertikal'nogo drenazha), W73-11094	4B
TURBULENT FLOW		Urban Hydrology for the Period Up to December 1971. W73-11698	4C	USSR (CHATKAL'SKIY-KURAMINSKY MTS.) Principles of Landslide Identification from Aerial Survey Data (Printsypr raspoznavaniya opolznevnykh protsessov po materialam aerofotos'yemki), W73-11100	2J
Numerical Thermal Plume Model for Vertical Outfalls in Shallow Water, W73-11333	5B	URBAN RUNOFF Annual Compilation and Analysis of Hydrologic Data for Urban Studies in the Fort Worth, Texas, Metropolitan Area, 1971, W73-11215	4C	USSR (GORNO-ALTAY AUTONOMOUS OBLAST) Rate of Retreat of Yuzhno-Chuya Glaciers in the Gorno-Altay Autonomous Oblast (O skorosti otstupaniya lednikov Yuzhno-Chuyskikh belkov Gornogo Altaya), W73-11097	2C
Unified Formulation of Wall Turbulence, W73-11346	2D	Effects of Urbanization on Floods in the Houston, Texas, Metropolitan Area, W73-11402	4C	USSR (KAZAKHSTAN) Distribution of Trace Elements in Bodies of Water of Kazakhstan (Raspredeleniye mikroelementov v vodoyemakh Kazakhstana), W73-11413	2K
U.S. ATOMIC ENERGY COMMISSION		URBANIZATION Effects of Land Use and Retention Practices on Sediment Yields in the Stony Brook Basin, New Jersey, W73-11113	4C	USSR (KOLYMA RIVER) Upper Permian Glaciomarine Deposits in the Kolyma River Basin (Verkhneperm'skiye ledovo-morskiye otlozheniya basseyna istokov r. Kolomyi), W73-11103	2J
Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington, W73-11204	5B	Annual Compilation and Analysis of Hydrologic Data for Urban Studies in the Fort Worth, Texas, Metropolitan Area, 1971, W73-11215	4C	USSR (PAMIRS) Inflow to Rivers in the Pamirs (Pitaniye rek Pamira), W73-11096	2C
UKRAINE		Qualitative Values in Environmental Planning: A Study of Resource Use in Urbanizing Watersheds, W73-11253	5G	USSR (SAYAN MOUNTAINS) Investigation of Seasonal Variability of Runoff on Rivers in the Altay and Sayan Mountain Systems (Issledovaniye vnutrigodovoy neravnomernosti stoka rek Altaya i Sayan), W73-1101	2E
Formation and Forecast of Components in the Hydrologic Regimen of Rivers (Formirovaniye i prognozirovaniye elementov gidrologicheskogo rezhima rek). W73-11688	2E	Public Participation in Urban Water Planning, W73-11257	6B	USSR (TUVA ASSR) Distribution and Composition of Mineral Water in the Tuva Autonomous Republic (Zakonomernosti rasprostraneniya i sostav podzemnykh mineral'nykh vod Tuvy), W73-11412	2F
Investigation of the Dynamics and Calculation of the Losses of Spring Runoff in a Small River Basin (Issledovaniye dinamiki i rascheta poter' vesennego stoka v malom rechnom basseyne), W73-11690	2E	The Estimation of the Hydrologic Impact of Urbanization: An Example of the Use of Digital Simulation in Hydrology. W73-11259	4C	UTAH	
Forecasting Quarterly Inflow of Water to Dnieper River Reservoirs During the Cold Half of the Year (O prognozirovaniyi kvartal'nogo pritoka vody v dneprovskiy vodokhranilishcha za kholodnyu polovinu goda), W73-11691	2H	Urban Hydrology for the Period Up to December 1971. W73-11698	4C	The Relationship of Enzyme Kinetic Heterotrophy Analysis to Other Eutrophication Indices, W73-11432	5C
Use of Digital Computers to Compute Propagation of Flood Waves Along the Cascade of Reservoirs on the Dnieper River (Primneniye ETsVM diya rascheta rasprostraneniya voln polovodiy po kaskadu gidrouzlov na Dnepre), W73-11693	2E	URINE Biochemical Tests for the Appraisal of Exposure to Lead, W73-11309	5C	UTAH LAKE	
ULTIMATE STRENGTH DESIGN		New Picogram Detection System Based on a Mass Spectrometer With an External Ionization Source at Atmospheric Pressure, W73-11608	5A	Pesticides in Water, W73-11618	5B
Simplified Computer Approach to the Ultimate Load Analysis and Design of Reinforced Concrete Frames, W73-11499	8F	USSR Preservation of Lake Baykal (Ob okhrane ozero Baykal), W73-11407	5C		
ULTRAPURE WATER		Information on Activities of the Commission on Surface Waters of the International Association of Scientific Hydrology (IASH) (Informatsiya o rabote komissii poverkhnostykh vod			
Ultrapurity in Trace Analysis, W73-11483	5A				
UNSATURATED FLOW					
Capillary-Diffusion and Self-Diffusion of Liquid Water in Unsaturated Soils, W73-11390	2G				
UNSTRUCTURED FIBERS					
Removal of Oil From Water Surfaces By Sorption on Unstructured Fibers, W73-11586	5G				
UPPER HOUSATONIC RIVER BASIN (CONN)					
Water Resources Inventory of Connecticut: Part 6. Upper Housatonic River Basin, W73-11555	2A				

SUBJECT INDEX

UTILITY EXTENSION PLANNING

UTILITY EXTENSION PLANNING
 Regional Waste Water, Solid Waste Disposal, Water Supply, and Storm Drainage Systems Appraisal.
 W73-11252

Public Utilities in Winnebago County.
 W73-11263

UV-PHOTOELECTRON SPECTROSCOPY

Recent Developments in the Analytical Application of UV Photoelectron Spectroscopy,
 W73-11489

VACUUM SKIMMING UNIT

A Small Vacuum Oil Skimming System,
 W73-11436

VARIABILITY

Investigation of Seasonal Variability of Runoff on Rivers in the Altay and Sayan Mountain Systems (Issledovaniye vnutrigodovoy neravnomernosti stoka rek Altaya i Sayana),
 W73-11101

Nutrient Ratio Variation in Reservoir Sediments,
 W73-11591

VEGETABLE WASTES

Low Water Volume Enzyme Deactivation of Vegetables Before Preservation,
 W73-11330

VEGETATION

Lead Pollution from a Factory Manufacturing Anti-Knock Compounds,
 W73-11290

VELOCITY

Problem of the Influence of Shape of Channel Cross Section on Velocity Distribution in a Uniform Turbulent Flow (K voprosu o vliyaniye formy secheniya ruchni na raspredeleniye skorostey v ravnomernom turbulentnom potokе),
 W73-11408

VELOCITY GRADIENT

Water-Solids Separation in an Upflow: With Particular Reference to Use of a Slurry Pool for Solids Contact in Water Treatment,
 W73-11313

VERSATILITY

Comparison of Selective Ion Monitoring and Repetitive Scanning During Gas Chromatography-Mass Spectrometry,
 W73-11493

VERTICAL ALIGNEMENT

Least Cost Method for Sewer Design,
 W73-11360

VIRGIN ISLANDS

Water Records of the U.S. Virgin Islands, 1962-69,
 W73-11396

VIRGINIA

Virginia Small Streams Program, Preliminary Flood-Frequency Relations,
 W73-11090

VITAMIN B-12

The Seasonal Cycle of Vitamin B12 in the Strait of Georgia, British Columbia,
 W73-11578

VOID RATIO

Coefficient of Permeability of Highly Plastic Clays,
 W73-11199

WASTE DISPOSAL WELLS

Numerical Techniques Applied to Particle Deposition During Slot Flow,
 W73-11697

2J

WASTE IDENTIFICATION

Assessing the Water Pollution Potential of Manufactured Products,
 W73-11334

SB

Pyrographic Gross Characterization of Water Contaminants,
 W73-11446

SA

WASTE SOURCE QUANTIFICATION

Pyrographic Gross Characterization of Water Contaminants,
 W73-11446

SA

WASTE TREATMENT

Recover Zinc From Zinc Ash,
 W73-11281

SD

WASTE WATER

Waste Water Sampler,
 W73-11243

SA

WASTE WATER DISPOSAL

Regional Waste Water, Solid Waste Disposal, Water Supply, and Storm Drainage Systems Appraisal,
 W73-11252

SG

Numerical Thermal Plume Model for Vertical Outfalls in Shallow Water,
 W73-11333

SB

Ecological and Physiological Implications of Greenbelt Irrigation - Phase I,
 W73-11424

SD

Disposal of Uranium-Mill Effluent by Well Injection in the Grants Area, Valencia County, New Mexico,
 W73-11551

SE

WASTE WATER (POLLUTION)

Occurrence of Salmonella in Oxidation Ditches,
 W73-11136

SA

Petroleum Hydrocarbons and Fatty Acids in Wastewater Effluents,
 W73-11575

SB

Phosphorus in Waste Water,
 W73-11592

SD

WASTE WATER TREATMENT

Cannery Wastewater Treatment with Rotating Biological Contactor and Extended Aeration,
 W73-11058

SD

Marine Sanitation System Demonstration,
 W73-11059

SD

Steam Stripping Odorous Substances from Kraft Effluent Streams (SEKOR),
 W73-11060

SD

Aerobic Secondary Treatment of Plywood Glue Wastes,
 W73-11065

SD

Solvent Extraction Status Report,
 W73-11066

SD

Characterization of the Activated Sludge Process,
 W73-11069

SD

SUBJECT INDEX

WATER CONTROL

The Northern Maine Regional Treatment System, W73-11079	SD	Ultra High Rate Filtration of Activated Sludge Plant Effluent, W73-11337	SD	Improved Method for Characterizing Environmental Hydrocarbons by Gas Chromatography, W73-11607	5A
State-of-the-Art Review of Pulp and Paper Waste Treatment, W73-11080	SD	Secondary Waste Treatment for a Small Diversified Tanner, W73-11340	SD	Pesticides in Water, W73-11618	5B
Occurrence of Salmonella in Oxidation Ditches, W73-11136	5A	Sludge Concentration, W73-11357	SD	Organochlorine Insecticides in Surface Waters in Germany-1970 and 1971, W73-11628	5C
Removal of Mercury from Aqueous Solutions by Nitrogen-Containing Chemically Modified Cotton, W73-11174	SD	Apparatus for Separating Pollutants and Obtaining Separate Liquids and Solids, W73-11359	SD	The Heavy Metal Content of Rainfall in the East Midlands, W73-11648	5A
Process for the Removal of Cyanide from Sewage by Means of Formaldehyde, W73-11224	SD	A Dynamic programming approach for Investment Strategies in Wastewater Treatment Plants, W73-11426	SD	WATER BALANCE	
De-Oiling of Polluted Waters, W73-11226	SD	National Meat-Packing Waste Management Research and Development Program, W73-11440	SD	A Principles Study of Factors Affecting the Hydrological Balance of the Lemon Glacier System and Adjacent Sectors of the Juneau Icefield, Southeastern Alaska, 1965-1969, W73-11054	2C
Water Purification With Porous Abrasives, W73-11228	SD	Construction of a Purification Plant for Polluted Water Using Photosynthetic Bacteria, W73-11369	SD	The Environmental Tritium Concentration of Underground Water and Its Hydrological Interpretation, W73-11544	2F
Accelerated Biological-Chemical Wastewater Treatment, W73-11229	SD	WASTES		WATER CHEMISTRY	
Apparatus for Treating Sewage, W73-11231	SD	An Investigation of Environmental Pollution by Lead and Other Heavy Metals from Industrial Development in Southeastern Missouri, W73-11270	5B	The Changing Chemistry of the Oceans. W73-11367	5B
Skimming Device for use on a Liquid Surface, W73-11233	SD	WATER		Physical Models of Large Scale Ocean Circulation, W73-11368	2E
Purification of Waste Water, W73-11238	SD	Discrete Gradient Optimization of Water Systems, W73-11365	8B	Nitrous Oxide in Air and Sea Water over the Atlantic Ocean, W73-11370	5B
Activated Sludge Sewage Treatment Process and System, W73-11239	SD	WATER ANALYSIS		Some Aspects of the Geochemistry of Marine Aerosols, W73-11372	2K
Activated Sludge Process and System, W73-11240	SD	Water Quality Investigations: Souris River Basin, North Dakota, 1969, W73-11115	5B	The Role of the Oceans and Biosphere in the Carbon Dioxide Cycle, W73-11373	2K
Tertiary Filtering Arrangement, W73-11241	SD	Water Sampling Guidelines and Interpretation of Data, W73-11205	7A	The Chemical Stability of the Oceans and the CO ₂ System, W73-11374	2K
Apparatus for Handling Sewage, W73-11242	SD	Water Analysis, W73-11285	2K	Geological, Geochemical and Environmental Implications of the Marine Dust Veil, W73-11383	5B
Curtailing Pollution from Metal Finishing, W73-11283	SD	Distribution of Dissolved Mercury in the Irish Sea, W73-11293	5B	Sulfate Reduction, Pyrite Formation, and the Oceanic Sulfur Budget, W73-11386	5B
Chlorine Makers Clutch at Last Drops of Mercury, W73-11288	SD	Atomic Absorption Spectrophotometry as a Tool for the Water Chemist, W73-11294	5A	Distribution and Composition of Mineral Water in the Tuva Autonomous Republic (Zakonomernosti rasprostraneniya i sostav podzemnykh mineral'nykh vod TUVY), W73-11412	2F
Phosphorus Removal, A Bibliography, Volume I, W73-11319	SD	Atomic Absorption Spectrophotometry in the Field of Marine Research, W73-11298	5A	WATER CIRCULATION	
Phosphorus Removal, A Bibliography, Volume 2, W73-11320	SD	A Study of Coastal Water Quality in the Vicinity of San Juan, Puerto Rico, January 13-31, 1971, W73-11388	5B	Circulation Patterns in Lake Superior, W73-11342	2H
Biological Removal of Carbon and Nitrogen Compounds from Coke Plant Wastes, W73-11328	SD	Anodic Stripping Voltammetry at a Tubular Mercury-Covered Graphite Electrode, W73-11484	5A	Volume Transport, Salinity Distribution and Net Circulation in the Duplin Estuary, Georgia, W73-11425	2L
Dyestuff Color Removal by Ionizing Radiation and Chemical Oxidation, W73-11329	SD	Spectrophotometric Method for Determination of Ozone in Aqueous Solutions, W73-11495	5A	WATER CONSERVATION	
Low Water Volume Enzyme Deactivation of Vegetables Before Preservation, W73-11330	SD	Analysis of Sea Water by Difference Chromatography. Summary of Progress 1972, W73-11584	5A	Preservation of Lake Baykal (Ob okhrane ozer Baykal), W73-11407	5C
Economic Feasibility of Minimum Industrial Waste Load Discharge Requirements, W73-11335	SD	Copper Determination in Water by Standard Addition Potentiometry, W73-11605	5A	WATER CONTROL	
				Effects of Submerged Sills in the St. Clair River, W73-11089	8B

SUBJECT INDEX

WATER COSTS

WATER COSTS	
Nuclear Dual Purpose Plants in Regional Development, W73-11496	3A
WATER CURRENTS	
Circulation Patterns in Lake Superior, W73-11342	2H
WATER DEMAND	
Radial Collector Well Solves Water Supply Problem, W73-11473	8B
WATER DEMANDS	
Scope of Public Water Supply Needs. W73-11245	6D
WATER DISTRIBUTION	
Public Utilities in Winnebago County. W73-11263	3D
WATER DISTRIBUTION (APPLIED)	
Two-Point Copper Sulfating Program Licks/Algae Problem, W73-11447	5F
WATER HARDNESS	
Infant Mortality and Hardness of Local Water Supplies, W73-11144	5C
WATER LEVEL FLUCTUATIONS	
Reservoir Bank Storage, W73-11542	2H
Biological Effects of Fluctuating Water Levels in the Snake River, Grand Teton National Park, Wyoming, W73-11594	2E
WATER LEVELS	
Effects of Submerged Sills in the St. Clair River, W73-11089	8B
Groundwater Levels in Nebraska, 1972, W73-11120	4B
WATER LOSS	
Investigation of the Dynamics and Calculation of the Losses of Spring Runoff in a Small River Basin (Issledovaniye dinamiki i raschet poteri vedennego stoka v malom rechnoym basseyne), W73-11690	2E
WATER MANAGEMENT	
The Evolving Role of the Federal Government in the Management of Lake Michigan, W73-11247	6E
WATER MANAGEMENT (APPLIED)	
Prediction Modeling for Salinity Control in Irrigation Return Flows, W73-11441	5G
A Mathematical Model to Aid Management of Outflow from the Okavango Swamp, Botswana, W73-11543	6A
WATER MITES	
Ecology of Yellowstone Thermal Effluent Systems: Intersects of Blue-Green Algae, Grazing Flies (Paracoenia, Ephydriidae) and Water Mites (Partnunelia, Hydrachnidae), W73-11131	5C

WATER POLICY	
Research and Development in Water Resources, Water Resources Research, Its Role in the Total R and D Spectrum, W73-11341	6B
WATER POLLUTION	
Isolation of Salmonellae from Moderately Polluted Waters, W73-11134	5A
Lead Contamination of Snow, W73-11275	5B
Multilevel Control of Multipollutant System, W73-11363	5G
Pyrographic Gross Characterization of Water Contaminants, W73-11446	5A
Sublethal Effects of Bleached Kraft Pulp Mill Effluent on Respiration and Circulation in Sockeye Salmon (<i>Oncorhynchus nerka</i>), W73-11615	5C
Pollution Effects on Phycovirus and Host Algae Ecology, W73-11635	5C
WATER POLLUTION CONTROL	
Accelerated Biological-Chemical Wastewater Treatment, W73-11229	5D
Waste Water Sampler, W73-11243	5A
Control of Hazardous Chemical Spills by Physical Barriers, W73-11338	5G
National Meat-Packaging Waste Management Research and Development Program, W73-11440	5D
Smithsonian Advisory Committee Report on Studies of the Effects of Waste Disposal in the New York Bight, W73-11642	5C
MSB Computerized Combined Sewer Control System, W73-11673	5G
The Need for Hydrogeologic Evaluations in a Mine Drainage Abatement Program: A Case Study, Toms Run, Clarion County, Pennsylvania, W73-11674	5G
WATER POLLUTION EFFECTS	
Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington, W73-11204	5B
Fish and Food Organisms in Acid Mine Waters of Pennsylvania, W73-11332	5C
Effects of Logging on Periphyton in Coastal Streams of Oregon, W73-11582	5C
Effect of Chlorine on Fluorescent Dyes, W73-11597	5C
A Cyprinodontid Fish, <i>Jordanella floridae</i> , as a Laboratory Animal for Rapid Chronic Bioassays, W73-11598	5C
The Influence of Simazine on the Photosynthetic Pigments of Green Algae, W73-11610	5C
Effects of a 12-Hr and 25-Day Exposure to Kraft Pulp Mill Effluent on the Blood and Tissues of Juvenile Coho Salmon (<i>Oncorhynchus kisutch</i>), W73-11620	5C
Survival and Gill Condition of Bluegill (<i>Lepomis macrochirus</i>) and Fathead Minnows (<i>Pimephales promelas</i>) Exposed to Sodium Nitrilotriacetate (NTA) for 28 Days, W73-11621	5C
Pollution Effects on Phycovirus and Host Algae Ecology, W73-11635	5C
Smithsonian Advisory Committee Report on Studies of the Effects of Waste Disposal in the New York Bight, W73-11642	5C
Low pH Values Shown to Affect Developing Fish Eggs (<i>Brachydanio rerio</i> Ham.-Buch.), W73-11651	5C
WATER POLLUTION SOURCES	
Tritium Concentration of a Variety of Water Samples: Fifth Listing, W73-11104	5B
North Atlantic Regional Water Resources Study : Appendix H, Minerals. W73-11107	3D
Phosphorus Losses From Four Agricultural Watersheds on Missouri Valley Loess, W73-11209	5B
Industrial Waste Survey, Dade County, Florida. W73-11217	5B
A Study of Coastal Water Quality in the Vicinity of San Juan, Puerto Rico, January 13-31, 1971. W73-11388	5B
Investigations into the Occurrence of Coliform Organisms from Pristine Streams, W73-11428	5B
Report on Evaluations of Waste Sources in the Calcasieu River Basin, Louisiana. W73-11529	5B
Movement of Acarol and Terbicil Pesticides During Displacement Through Columns of Wabasso Fine Sand, W73-11537	5B
Measurement of Salt-Wedge Excursion Distance in the Duwamish River Estuary, Seattle, Washington, by Means of the Dissolved-Oxygen Gradient, W73-11564	5B
System Study for Surveillance of Ocean Dumping Operations. W73-11573	5B
Dispersed and Particulate Petroleum Residues in the Gulf of St. Lawrence, W73-11612	5B
Pesticides in Water, W73-11618	5B
Pollution Effects on Phycovirus and Host Algae Ecology, W73-11635	5C

SUBJECT INDEX

WATER RESOURCES DEVELOPMENT

Influence of Agricultural Practices on Water Quality in Nebraska: A Survey of Streams, Groundwater, and Precipitation, W73-11696	5B	Method and Apparatus for Detecting the Hardness Level of Water, W73-11227	7B	Supplementation of Missing Values in Water Quality Data, W73-11687	5G
WATER POLLUTION TREATMENT		Water Decomposition Apparatus, W73-11234	5F	WATER QUALITY RECORDS (ALA)	
Ozonation at Whiting: 26 Years Later, W73-11316	5F	Liquid Sampling, W73-11235	7B	Water Resources Data for Alabama, 1970: Part 2. Water Quality Records, W73-11085	2K
Control of Hazardous Chemical Spills by Physical Barriers, W73-11338	5G	H ₂ S Removal from Water Without Air Pollution, W73-11314	5F	WATER QUALITY STANDARDS	
The Thermal Conductivity of Pure Water and Standard Sea Water as a Function of Pressure and Temperature: Part II—Pure Water, W73-11084	2K	Ozonation at Whiting: 26 Years Later, W73-11316	5F	Progressive Taxation as a Policy for Water Quality Management, W73-11147	5G
WATER PURIFICATION		Taste and Odor Control in Water, W73-11318	5F	Preservation of Lake Baykal (Ob okhrane ozero Baykal), W73-11407	5C
Centrifugal Distillation System, W73-11223	3A	Nonlinear Parameter Estimation in Water Quality Modeling, W73-11361	5B	Progress Report on Water Quality of Lake Michigan Near Chicago, W73-11581	5B
Water Purification With Porous Abrasives, W73-11228	5D	A Study of Coastal Water Quality in the Vicinity of San Juan, Puerto Rico, January 13-31, 1971, W73-11388	5B	WATER REQUIREMENTS	
Water Decomposition Apparatus, W73-11234	5F	Water Records of the U.S. Virgin Islands, 1962-69, W73-11396	2E	Water Requirements for Optimum Crop Yield, W73-11507	3F
Purification of Waste Water, W73-11238	5D	Ground-water Basic Data of Cavalier and Pembina Counties, W73-11397	4B	WATER RESOURCES	
Reverse Osmosis Water Purifying System with Gradient Barrier Water Storage Container, W73-11356	3A	Report on Evaluations of Waste Sources in the Calcasieu River Basin, Louisiana, W73-11529	5B	Peak Load Pricing Model of an Electric Utility Using Pumped Storage, W73-11146	6A
WATER QUALITY		Water Resources Inventory of Connecticut: Part 6. Upper Housatonic River Basin, W73-11555	2A	Progressive Taxation as a Policy for Water Quality Management, W73-11147	5G
Phosphorus Release from Lake Sediments, W73-11072	5C	Availability of Groundwater for Public-Water Supply in Central and Southern Escambia County, Florida: Interim Report, July 1972, W73-11563	2F	Water Resources of Hempstead, Lafayette, Little River, Miller, and Nevada Counties, Arkansas, W73-11222	4B
Water Resources Data for Alabama, 1970: Part 2. Water Quality Records, W73-11085	2K	Ground-Water Quality in Wisconsin Through 1972, W73-11568	2F	River Systems Transition Function and Operation Study, W73-11364	4A
Ground Water in Finney County, Southwestern Kansas, W73-11106	7C	Progress Report on Water Quality of Lake Michigan Near Chicago, W73-11581	5B	Hydrologic Records for Volusia County, Florida: 1971-72, W73-11399	7C
North Atlantic Regional Water Resources Study : Appendix H, Minerals, W73-11107	3D	Smithsonian Advisory Committee Report on Studies of the Effects of Waste Disposal in the New York Bight, W73-11642	5C	Hydrology and Water Resources Development in Nepal, W73-11401	4A
Characteristics and Environmental Quality of Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York, W73-11108	2K	WATER QUALITY CONTROL		Hydrology of Truckee Meadows, Nevada, W73-11430	4B
Survey of Water Quality and Sediments in Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York (Appendix to Technical Report No. 14), W73-11109	2K	Waste Water Sampler, W73-11243	5A	Water Resources Inventory of Connecticut: Part 6. Upper Housatonic River Basin, W73-11555	2A
Water Quality Investigations: Souris River Basin, North Dakota, 1969, W73-11115	5B	Colorado River Water Quality Improvement Program, W73-11264	5G	Natural Resource Information System Remote Sensing Studies, W73-11571	7B
Water Quality Models for Total Coliform, W73-11135	5B	Multilevel Control of Multipollutant System, W73-11363	5G	Linear Programming use for Evaluating Water Resources and Cost and Benefit Allocation, W73-11683	6A
Progressive Taxation as a Policy for Water Quality Management, W73-11147	5G	Rehabilitation of Irrigation Systems for Salinity Control, W73-11509	3F	Aesthetic Preference for Water Resource Projects: An Application of Q Methodology, W73-11684	6B
Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management, W73-11150	5G	Simultaneous, Multiple-Level Release from Stratified Reservoirs, W73-11567	8B	WATER RESOURCES DEVELOPMENT	
Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington, W73-11204	5B			Behavior of Groundwater Flow Subject to Time-Varying Recharge, W73-11142	2F
				Stream Depletion Factors, Arkansas River Valley, Southeastern Colorado: A Basis for Evaluating Plans for Conjunctive Use of Ground and Surface Water, W73-11221	4B

SUBJECT INDEX

WATER RESOURCES DEVELOPMENT

Hydrology and Water Resources Development in Nepal, W73-11401	4A	Scope of Public Water Supply Needs. W73-11245	6D	Water-Solids Separation in an Upflow: With Particular Reference to Use of a Slurry Pool for Solids Contact in Water Treatment, W73-11313	5F	
Towing Icebergs to Irrigate Arid Lands--Manna or Madness, W73-11566	6F	Emerging Water Supply Technology. W73-11246	3D	H2S Removal from Water Without Air Pollution, W73-11314	5F	
WATER REUSE		Water Supply Plan for the Southeastern Connecticut Region, Volume II, Recommended Plan. W73-11249	6B	Water Supply Improvements Feature New Coagulator, W73-11315	5F	
National Meat-Packaging Waste Management Research and Development Program, W73-11440		5D	Comprehensive Water Sewer Plan for Baldwin County, Alabama. W73-11261	5D	Ozonation at Whiting: 26 Years Later, W73-11316	5F
WATER REUSE		Comprehensive Water and Sewer Plan for Escambia County, Alabama. W73-11262	5D	A Water System Designed to Attract Industry, W73-11317	5F	
Solvent Extraction Status Report, W73-11066		5D	A Water System Designed to Attract Industry, W73-11317	5F	Taste and Odor Control in Water, W73-11318	5F
Emerging Water Supply Technology. W73-11246		3D	A Mathematical Model to Aid Management of Outflow from the Okavango Swamp, Botswana, W73-11543	6A	Activated Carbon for Water Treatment, W73-11352	5F
Ecological and Physiological Implications of Greenbelt Irrigation - Phase I, W73-11424		5D	Towing Icebergs to Irrigate Arid Lands--Manna or Madness, W73-11566	6F	Evaluation of New Algicides for Water Supply Purposes, W73-11353	5F
Wastewater Management Through Land Utilization - Muskegan County, Michigan, USA, W73-11515		5D	The Bacteriology of the Water Supplies of Rangoon: II. Cool Dry and Hot Dry Seasons, W73-11630	5C	Reverse Osmosis Water Purifying System with Gradient Barrier Water Storage Container, W73-11356	3A
WATER SAMPLING		Comprehensive Regional Water and Sewer Inventory and Analysis, W73-11670	7B	Helicopter Application of Copper Sulfate, W73-11419	5F	
Isolation of Salmonellae from Moderately Polluted Waters, W73-11134		5A	How to Black Out Algae, W73-11420	5F		
Water Sampling Guidelines and Interpretation of Data, W73-11205		7A	Taste and Odor Control - Chemicals and Methods, W73-11421	5F		
Liquid Sampling, W73-11235		7B	Activated Carbon for Palatable Water: Granular or powdered. W73-11422	5F		
A Flow Proportional Composite Sampler, W73-11463		5A	Two-Point Copper Sulfating Program Licks/Algae Problem, W73-11447	5F		
Observation Boreholes—Construction and Use: Final Report of Research Panel, No. 9. W73-11466		8A	Filter Washing Goes Modern, W73-11448	5F		
WATER SAMPLING GUIDELINES		WATER TEMPERATURE		Zeta Potential Control Improves Coagulation of Colloidal Water. W73-11449	5F	
Water Sampling Guidelines and Interpretation of Data, W73-11205		7A	The Thermal Conductivity of Pure Water and Standard Sea Water as a Function of Pressure and Temperature: Part II—Pure Water, W73-11084	2K	Microstraining Removes Algae and Cuts Filter Back-Washing, W73-11450	5F
WATER SOFTENING		Circulation Patterns in Lake Superior, W73-11342	2H	Design Factors for Effective Settling of Coagulated Water, W73-11451	5F	
Method and Apparatus for Detecting the Hardness Level of Water, W73-11227		7B	Effects of Logging on Periphyton in Coastal Streams of Oregon, W73-11582	5C	Softening A 46-Grain Water, W73-11665	5F
Softening of Sea Water By Addition of Barium Carbonate and CO ₂ , W73-11236		5F	Physical-Chemical Oceanographic Data from the North Pacific Ocean and Bering Sea, 1971, W73-11595	5A	Improved Water at Lower Cost Produced with Coagulant Aid, W73-11666	5F
Softening of Sea Water by Addition of Barium Carbonate and Mineral Acid, W73-11237		5F	WATER TRANSFER		60-MGD Microstraining Plant Meets Denver's Growing Needs, W73-11667	5F
Softening A 46-Grain Water, W73-11665		5F	Towing Icebergs to Irrigate Arid Lands--Manna or Madness, W73-11566	6F	Ozone for Supplementary Water Treatment, W73-11677	5F
WATER STORAGE		WATER TREATMENT		WATER TYPES		
Apollo Experience Report, Potable Water System, W73-11202		Method and Apparatus for Detecting the Hardness Level of Water, W73-11227	7B	Distribution and Composition of Mineral Water in the Tuva Autonomous Republic		
WATER SUPPLY		Water Decomposition Apparatus, W73-11234	5F			
Iterative Simulation Algorithm in Reservoir Systems Operation, W73-11139		Softening of Sea Water By Addition of Barium Carbonate and CO ₂ , W73-11236	5F			
Apollo Experience Report, Potable Water System, W73-11202		Softening of Sea Water by Addition of Barium Carbonate and Mineral Acid, W73-11237	5F			

SUBJECT INDEX

ZEOLITES

(Zakonomernosti rasprostraneniya i sostav podzemnykh mineral'nykh vod Tuvy), W73-11412	2F	The Impact of Weather Modification on U.S. Planning for the Rio Colorado and Rio Grande, W73-11505	3B	Brown County Sewage and Solid Waste Study - 1972, W73-11250	5E
WATER WELLS		Climate Change and the Influence of Man's Activities on the Global Environment, W73-11562	2A	Community Improvements and Service Costs, W73-11255	3D
Groundwater Data in the Corvallis-Albany Area, Central Willamette Valley, Oregon, W73-11093	4B	WEATHERING		Ground-Water Quality in Wisconsin Through 1972, W73-11568	2F
Ground Water in Finney County, Southwestern Kansas, W73-11106	7C	Influence of Weathering on Effective Values of Shear Strength of Miocene Clay, W73-11196	2K	WITHDRAWAL	
Groundwater Levels in Nebraska, 1972, W73-11120	4B	WEED CONTROL		Stream Depletion Factors, Arkansas River Valley, Southeastern Colorado: A Basis for Evaluating Plans for Conjunctive Use of Ground and Surface Water, W73-11221	4B
Oil Field Techniques Used to Increase Flow in Community Water Well, W73-11465	8A	Progress Report of Residue Studies on Organic Arsenicals used for Ditchbank Weed Control, W73-11497	4A	Limnology of Yellowtail Reservoir and the Big Horn River, W73-11331	5C
Operation and Capability of the Becker Hammer Drill, W73-11470	8C	WEIGHT LOSS		Simultaneous, Multiple-Level Release from Stratified Reservoirs, W73-11567	8B
Estimating Well Costs, W73-11476	8A	A Centrifuge Method for Determining Live Weights of Aquatic Insect Larvae, with a Note on Weight Loss in Preservative, W73-11647	5A	WOOD CHARACTERISTICS	
The Biggest Artesian Well in the World, W73-11481	8A	WELL CASINGS		The Effect of Environmental Factors on Wood Characteristics: I. The Influence of Irrigation on Pinus Radiata from South Australia, W73-11452	4A
Availability of Groundwater for Public-Water Supply in Central and Southern Escambia County, Florida: Interim Report, July 1972, W73-11563	2F	Efficiency of Well Screens and Gravel Packs: Final Report of Research Panel, No 6, W73-11474	8D	WYOMING	
WATER WORKS		WELL DATA		Limnology of Yellowtail Reservoir and the Big Horn River, W73-11331	5C
Systems Approach to Training and Licensing of Water Works Personnel in Ontario, W73-11676	5F	Groundwater Data in the Corvallis-Albany Area, Central Willamette Valley, Oregon, W73-11093	4B	Financing Private Water Resource Development: Analysis of a State Loan Program, W73-11686	3F
WATER YIELD		WELL DIAMETERS		X-RAY PHOTOELECTRON SPECTROSCOPY	
Ground-water Basic Data of Cavalier and Pembina Counties, W73-11397	4B	Optimum Hole Diameter for Water Wells, W73-11468	8A	X-Ray Photoelectron Spectroscopy of Metals in Amino Acid Complexes and Proteins, (Rontgen-Photoelektronen-Spektroskopie von Metallen in Aminosäurekomplexen und Proteinen), W73-11121	5A
Watershed Research, W73-11534	2A	WELL SCREENS		X-RAY SPECTROSCOPY	
The Influence of Delayed Drainage on Data from Pumping Tests in Unconfined Aquifers, W73-11545	2F	Efficiency of Well Screens and Gravel Packs: Final Report of Research Panel, No 6, W73-11474	8D	X-Ray Photoelectron Spectroscopy of Metals in Amino Acid Complexes and Proteins, (Rontgen-Photoelektronen-Spektroskopie von Metallen in Aminosäurekomplexen und Proteinen), W73-11121	5A
WATER YIELD IMPROVEMENT		WELL STIMULATION		YELLOWSTONE NATIONAL PARK	
Oil Field Techniques Used to Increase Flow in Community Water Well, W73-11465	8A	Oil Field Techniques Used to Increase Flow in Community Water Well, W73-11465	8A	Ecology of Yellowstone Thermal Effluent Systems: Intersects of Blue-Green Algae, Grazing Flies (Paracoenia, Ephydidae) and Water Mites (Partimunielia, Hydrachnidae), W73-11131	5C
Salinity Control on a Borehole Source in Bunter Sandstone, W73-11469	4B	WHEAT-M		YUGOSLAVIA	
WAVES (WATER)		Fertilizer Response to the Physical Effects of Soil Compaction, W73-11280	3F	Environmental Contamination by Lead from a Mine and Smelter, W73-11267	5C
Spectra of Turbulent Fluctuations Over Ocean Waves, W73-11087	2B	WHITE PERCH		Biochemical Tests for the Appraisal of Exposure to Lead, W73-11309	5C
The Use of Ocean Tide Records to Detect Motions Premonitory to a Tectonic Event in the Long Beach, California Area, W73-11214	7B	Sublethal Effects of Baltimore Harbor Water on the White Perch, Morone americana, and the Hogchoker, Trinectes maculatus, W73-11652	5C	ZEA-MAYS-M	
Analysis of Lake Erie Wave Pressure Data, W73-11548	8B	WINDS		Response of Relative Water Content in Zea Mays L. to Changes of Potential in the Rhizosphere and Atmosphere, W73-11145	3F
WEATHER FORECASTING		A Power Wind Law for Turbulent Transfer Computations, W73-11344	2D	ZEOLITES	
Spectra of Turbulent Fluctuations Over Ocean Waves, W73-11087	2B	WINNIPEG (MANITOBA)		Softening A 46-Grain Water, W73-11665	5F
WEATHER MODIFICATION		Ozone for Supplementary Water Treatment, W73-11677	5F		
Emerging Water Supply Technology, W73-11246	3D	WINTER FLOUNDER			
		Influence of Lead and Other Metals on Fish Delta-Aminolevulinic Dehydrase Activity, W73-11646	5A		
		WISCONSIN			
		Plant Analysis for Nutrient Assay of Natural Waters, W73-11057	5C		

SUBJECT INDEX

ZERO DISCHARGE REQUIREMENT

- ZERO DISCHARGE REQUIREMENT**
Economic Feasibility of Minimum Industrial
Waste Load Discharge Requirements, 5D
W73-11335

- ZETA POTENTIAL**
Zeta Potential Control Improves Coagulation of
Colloidal Water, 5F
W73-11449

- ZINC**
Acute Zinc Toxicity to Rainbow Trout (*Salmo*
gairdneri): Confirmation of the Hypothesis that
Death is Related to Tissue Hypoxia, 5C
W73-11180

- Arsenic, Cadmium, Copper, Mercury, and Zinc
in Some Species of North Atlantic Finfish, 5B
W73-11279

- Recover Zinc From Zinc Ash, 5D
W73-11281

- The Occurrence and Seasonal Variation of
Trace Metals in the Scallops *Pecten maximus*
(L.) and *Chlamys opercularis* (L.), 5A
W73-11624

- The Accumulation from Water of ZN-65, MN-
54, CO-58, and FE-59 by the Mussel, *Mytilus*
edulis, 5A
W73-11625

- ZOOPLANKTON**
Study of the Respiration and the Nitrogen and
Phosphorus Excretion of Zooplanktonic Popu-
lations of the Mauritanian Upwelling, (March-
April 1972). (Etude de la Respiration et de
l'Excretion d'Azote et de Phosphore des Popu-
lations Zooplanctoniques de l'Upwelling Mau-
ritanien (Mars-Avril 1972), 5B
W73-11603

- Planktonic Changes Following the Restoration
of Lake Trumen, Sweden, 5G
W73-11639

- ZYgomycetes**
Application of the Fluorescent Antibody
Technique to the Differentiation of *Aspergillus*
Species, *Candida* Species and Zygomycetes in
Paraffin Section of Formalin-Fixed Tissues,
5A
W73-11126

AUTHOR INDEX

ABADIE, A. De-Oiling of Polluted Waters, W73-11226	5D	ANDERSON, M. L. Community Improvements and Service Costs, W73-11255	3D	BAKER, A. D. Recent Developments in the Analytical Application of UV Photoelectron Spectroscopy, W73-11489	5A
ADAMS, W. A. The Heavy Metal Content of Rainfall in the East Midlands, W73-11648	5A	ANDERSON, P. W. Effects of Land Use and Retention Practices on Sediment Yields in the Stony Brook Basin, New Jersey, W73-11113	4C	BAKER, J. An Environmental Evaluation System for Water Resource Planning, W73-11151	6A
ADAMS, W. M. Direct Determination of the Electromagnetic Reflection Properties of Smooth Brackish Water to the Continuous Spectrum from 100 million to 4 billion Hertz, W73-11052	2L	ANDERSON, W. L. Incidence of Mercury in Illinois Pheasants, W73-11305	5A	BAKER, J. E. Biological Removal of Carbon and Nitrogen Compounds from Coke Plant Wastes, W73-11328	5D
ADDINK, J. W. Water Infiltration Under Center-Pivot Sprinklers, W73-11514	8B	ANDERSSON, G. Planktonic Changes Following the Restoration of Lake Trumen, Sweden, W73-11639	5G	BAKER, J. M. Recovery of Salt Marsh Vegetation From Successive Oil Spillages, W73-11649	5C
ATKIN, R. R. Optimum Hole Diameter for Water Wells, W73-11468	8A	ANDREWS, R. A. Linear Programming use for Evaluating Water Resources and Cost and Benefit Allocation, W73-11683	6A	BARA, J. P. Wetting Requirements to Improve Collapsing Foundation Soils, W73-11526	8D
ALEXANDER, A. L. Corrosion of Metals in Tropical Environments-- Copper and Wrought Copper Alloys, W73-11455	8G	APPEL, C. A. Electrical-Analog Model Study of a Hydrologic System in Southeast Florida, W73-11570	2A	BARA-TEMES, S. Volumetric Determination of Nickel by High Frequency Impedimetry, W73-11127	5A
ALEXANDER, E. L. Optimum Hole Diameter for Water Wells, W73-11468	8A	ARMSTRONG, D. E. Measurement of Exchangeable Inorganic Phosphate in Lake Sediments, W73-11596	5A	BARDE, N. K. Morphology and Distribution of Soils of Lower Ib Watershed, W73-11258	2G
ALEXANDER, L. G. Tube Identifier, W73-11155	3A	ARMSTRONG, E. L. Report of the United States Delegation Visit to the Soviet Union: July 24 to August 6, 1972, W73-11508	8C	BARDUHN, A. J. The Growth Rate of Ice Crystals: The Properties of Carbon Dioxide Hydrate A Review of Properties of 51 Gas Hydrates, W73-11156	3A
ALI, M. H. Retention and Release of Soil Water as Related to Mineralogy of the Soil Clays, W73-11256	2G	ARMSTRONG, J. M. A Dynamic programming approach for Investment Strategies in Wastewater Treatment Plants, W73-11426	5D	BARGMAN, R. D. Characterization of the Activated Sludge Process, W73-11069	5D
ALLISON, G. B. The Environmental Tritium Concentration of Underground Water and Its Hydrological Interpretation, W73-11544	2F	ARNETT, E. M. Salt and Nonelectrolyte Interactions in Water, W73-11166	1B	BARNHART, T. J. Oil Field Techniques Used to Increase Flow in Community Water Well, W73-11465	8A
ALVAREZ, R. Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material, W73-11339	5A	AUSTIN, J. H. Systems Approach to Training and Licensing of Water Works Personnel in Ontario, W73-11676	5F	BARRESI, J. A. The Northern Maine Regional Treatment System, W73-11079	5D
AMORE, J. M. Research on Reverse Osmosis Membranes for Purification of Wash Water at Sterilization Temperature (165°F), W73-11159	3A	AZZINARO, W. P. Ecological Monitoring of Two Beach Nourishment Projects in Broward County, Florida, W73-11528	2J	BARTENSTEIN, R. Solution of Problems on Interconnected AC Systems by Means of HVDC Transmission Systems, W73-11521	8C
ANDERS, W. W. Two-Point Copper Sulfating Program Licks/Algae Problem, W73-11447	5F	BABCOCK, R. E. Numerical Techniques Applied to Particle Deposition During Slot Flow, W73-11697	2J	BARTLETT, C. J. Physical-Chemical Oceanographic Data from the North Pacific Ocean and Bering Sea, 1971, W73-11595	5A
ANDERSON, F. E. The Use of Modern Chromium Accumulations to Determine Estuarine Sedimentation Rates, W73-11392	2L	BACKUS, R. H. Chlorinated Hydrocarbons in Open-Ocean Atlantic Organisms, W73-11377	5B	BARTLEY, T. R. Progress Report of Residue Studies on Organic Arsenicals used for Ditchbank Weed Control, W73-11497	4A
ANDERSON, J. L. Relationships Between Saturated Hydraulic Conductivity and Morphometric Data of an Argillite Horizon, W73-11211	2G	BAGUELIN, F. Expansion of Cylindrical Probes in Cohesive Soils, W73-11520	8D	BARTUSKA, J. F. Ozonation at Whiting: 26 Years Later, W73-11316	5F
ANDERSON, J. U. Short-Term Effects of Irrigation with High Sodium Waters, W73-11111	3C	BAILEY, O. F. Short-Term Effects of Irrigation with High Sodium Waters, W73-11111	3C	BASU, A. A Colorimetric Technique Suggested for Chemical Oxygen Demand Determination, W73-11599	5A

AUTHOR INDEX

BATSON, G.

BATSON, G.
Flexural Fatigue Strength of Steel Fiber Reinforced Concrete Beams,
W73-11498 8F

BAXI, C. B.
A Model for Rain Erosion of Homogeneous Materials,
W73-11560 8G

BAYARD, M. A.
Composition of Airborne Lead Particles,
W73-11188 5A

BEAN, R. C.
Investigation of Phase and State Relations in Complex Lipid Systems,
W73-11161 3A

BECHLEY, G. L.
Hydraulic Design of Stilling Basin for Pipe or Channel Outlets,
W73-11533 8B

BEITER, D. P.
Calcite Saturation in an Eastern Kentucky Karst Stream,
W73-11391 2K

BEKTUROV, A. B.
Distribution of Trace Elements in Bodies of Water of Kazakhstan (Raspredeleniye mikroelementov v vodoyemakh Kazakhstana),
W73-11413 2K

BELL, J. B.
Isolation of Salmonellae from Moderately Polluted Waters,
W73-11134 5A

BELLA, D. A.
Computer Simulation of Eutrophication,
W73-11051 5C

BENDER, M. E.
An In Situ Evaluation of Nutrient Effects in Lakes,
W73-11070 5C

BENNETT, D. W.
Operation and Capability of the Becker Hammer Drill,
W73-11470 8C

BERKELEY, K. G. C.
Cathodic Protection--Theory and Practice in the Water Industry,
W73-11472 8A

BERKOWITZ, J. B.
Assessing the Water Pollution Potential of Manufactured Products,
W73-11334 5B

BERMEJO-MARTINEZ, F.
Volumetric Determination of Nickel by High Frequency Impedimetry,
W73-11127 5A

BERNER, R. A.
Sulfate Reduction, Pyrite Formation, and the Oceanic Sulfur Budget,
W73-11386 5B

BERREY, J. L.
Aerial Surveillance Spill Prevention System,
W73-11326 5B

BERRY, E. G.
The Effects of Temperature on Growth and Reproduction of Aquatic Snails,
W73-11444 5C

Studies on Schistosomiasis in Mekong Basin: II. Malacological Investigations on Human Schistosoma from Laos,
W73-11633 5C

BETNEY, E.
A Study of a Small Tropical Lake Treated With the Molluscicide Frescon,
W73-11614 5C

BETTERIDGE, D.
Recent Developments in the Analytical Application of UV Photoelectron Spectroscopy,
W73-11489 5A

BETZER, F. R.
Sediments in the Atlantic Corner Seamounts: Control by Topography, Paleo-Winds, and Geochemically-Detected Modern Bottom Currents,
W73-11394 2J

BHATTACHARJEE, J. C.
Morphology and Distribution of Soils of Lower Ib Watershed,
W73-11258 2G

BIANCHI, R. A.
The Development and Demonstration of an Underwater Oil Harvesting Technique,
W73-11063 5G

BICZOK, E.
Behaviour of Transition Soils Under the Effect of Water,
W73-11198 2G

BIGGAR, J. W.
Simultaneous Transport of Chloride and Water During Infiltration,
W73-11213 2K

BINGHAM, G. S.
Spectra of Turbulent Fluctuations Over Ocean Waves,
W73-11087 2B

BIRD, S. J. G.
Remote Sensing Evaluation of Environmental Factors Affecting the Developmental Capacity of Inland Lakes,
W73-11540 7B

BISQUE, R. E.
Determination of Trace Mercury in Soil and Rock Media,
W73-11297 5A

BISWAS, T. D.
Retention and Release of Soil Water as Related to Mineralogy of the Soil Clays,
W73-11256 2G

BJORHOVDE, R.
A Probabilistic Approach to Maximum Column Strength,
W73-11516 8A

BOARI, G.
Apparatus for Use in an Improved Electro-Dialysis Process,
W73-11230 3A

BOBENRIETH, P.
Sea Fish Contamination With Mercury (Contamination des poissons de mer par le mercure),
W73-11289 5C

BOERNGEN, J. G.

Lithium in Surficial Materials of the Continental United States and Partial Data on Cadmium,
W73-11268 5B

BOHAN, J. P.
Simultaneous, Multiple-Level Release from Stratified Reservoirs,
W73-11567 8B

BOLTER, E.
Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri,
W73-11271 5C

The Lead Industry as a Source of Trace Metals in the Environment,
W73-11269 5B

BOND, A. W.
Water-Solids Separation in an Upflow: With Particular Reference to Use of a Slurry Pool for Solids Contact in Water Treatment,
W73-11313 5F

BOOM, A. A.
Investigation of Polybenzimidazole Hollow Fiber Reverse Osmosis Desalination Membranes,
W73-11157 3A

BOORUYJ, S.
Tertiary Filtering Arrangement,
W73-11241 5D

BOOS, W. R.
Gas Chromatographic and Mass Spectrometric Studies of S-Alkyl Derivatives of N,N-Dialkyl Dithiocarbamates,
W73-11622 5A

BORGERDING, J.
Characterization of the Activated Sludge Process,
W73-11069 5D

BOROS, J. A.
Oxidation of Pyrites in Chlorinated Solvents,
W73-11068 5D

BOUCHARD, R. W.
A New Crayfish of the Subgenus Jugicambarus from Tennessee with an Emended Definition of the Subgenus (Astacidae, Decapoda),
W73-11590 5A

BOULTON, N. S.
The Influence of Delayed Drainage on Data from Pumping Tests in Unconfined Aquifers,
W73-11545 2F

BOUMA, J.
Relationships Between Saturated Hydraulic Conductivity and Morphometric Data of an Argillic Horizon,
W73-11211 2G

BOUSE, G. M.
Use of Physical Methods to Expand Soil Survey Interpretations of Soil Drainage Conditions,
W73-11210 2G

BOUSH, G. M.
Pesticide Degradation by Marine Algae,
W73-11601 5B

Phenylmercuric Acetate: Metabolic Conversion by Microorganisms,
W73-11187 5B

AUTHOR INDEX

CAMFIELD, F. E.

- BOWEN, V. T.**
Chlorinated Hydrocarbons in Open-Ocean Atlantic Organisms, W73-11377 5B
- BOWERSOX, J. P.**
Development of a Mobile System for Cleaning Oil-Contaminated Beaches, W73-11064 5G
- BOWMAN, M. J.**
Hydrographic Study of the Shelf and Slope Waters of New York Bight, W73-11110 2E
- BRADLEY, B. W.**
Oxygen--A Major Element in Drill Pipe Corrosion, W73-11453 8G
- BRADSHAW, J. S.**
Pesticides in Water, W73-11618 5B
- BRAMER, HENRY C.**
Economic Feasibility of Minimum Industrial Waste Load Discharge Requirements, W73-11335 5D
- RAY, D. T.**
Reverse Osmosis Water Purifying System with Gradient Barrier Water Storage Container, W73-11356 3A
- RAY, J. T.**
Phosphate in Interstitial Waters of Anoxic Sediments: Oxidation Effects During Sampling Procedure, W73-11118 5B
- BRENNEMAN, D. R.**
Oxidation of Pyrites in Chlorinated Solvents, W73-11068 5D
- BRETT, J. R.**
Effects of Sublethal Concentrations of Sodium Pentachlorophenate on Growth Rate, Food Conversion Efficiency, and Swimming Performance in Underyearling Sockeye Salmon (*Oncorhynchus nerka*), W73-11656 5C
- BRETT, R. W. J.**
Generic Feed Forward Control of Activated Sludge, W73-11362 5D
- BRICKER, O. P.**
Phosphate in Interstitial Waters of Anoxic Sediments: Oxidation Effects During Sampling Procedure, W73-11118 5B
- BROWN, D. F.**
Mass Spectrometric Identification of Some bis-2,4-Dinitrophenylhydrazones, W73-11487 5A
- BROWN, J. A. JR.**
BOD: Determining the Necessary Dilution Technique, W73-11661 5A
- BROWN, L. C.**
Least Cost Method for Sewer Design, W73-11360 5G
- BROWN, S. R.**
A Quantitative, Semiroutine Method for Determining Algal and Sedimentary Chlorophyll Derivatives, W73-11637 5A
- BRUNER, F.**
Improved Double Detection Gas Chromatograph-Mass Spectrometer Interface for the Analysis of Complex Organic Mixtures, W73-11663 5A
- BRUNGS, W. A.**
Acute and Long-Term Accumulation of Copper by the Brown Bullhead, *Ictalurus Nebulosus*, W73-11593 5C
- BRUTSAERT, W.**
Computing Evapotranspiration by Geostrophic Drag Concept, W73-11345 2D
- Perturbation Solution of an Equation of Atmospheric Turbulent Diffusion, W73-11348 2D
- A Power Wind Law for Turbulent Transfer Computations, W73-11344 2D
- Radiation, Evaporation and the Maintenance of Turbulence under Stable Conditions in the Lower Atmosphere, W73-11343 2D
- Sensitivity of the Solution for Heat Flux or Evaporation to Off-Diagonal Turbulent Diffusivities, W73-11347 2D
- A Solution for Simultaneous Turbulent Heat and Vapor Transfer between a Water Surface and the Atmosphere, W73-11349 2D
- BRYAN, G. W.**
The Occurrence and Seasonal Variation of Trace Metals in the Scallops *Pecten maximus* (L.) and Clamays *opercularis* (L.), W73-11624 5A
- BUNTING, S. C.**
Watershed Research, W73-11534 2A
- BURGES, S. J.**
Probabilistic Short-Term River Yield Forecasts, W73-11366 4A
- BURM, R. J.**
Cannery Wastewater Treatment with Rotating Biological Contactor and Extended Aeration, W73-11058 5D
- BURNETT, H. J.**
Apparatus for Separating Pollutants and Obtaining Separate Liquids and Solids, W73-11359 5D
- BURNEY, J. R.,**
Hydraulics of Shallow Flows Over Stable Eroded Sand Surfaces Defined by Area Spectra, W73-11192 2A
- BURRELL, D. C.**
Atomic Absorption Spectrophotometry in the Field of Marine Research, W73-11298 5A
- BURRIS, K. W.**
Parasite Copepods of Some Freshwater Fishes from North Carolina, W73-11143 2I
- BURT, O. R.**
Stochastic Reservoir Management and System Design for Irrigation, W73-11152 3F
- BURTON, D. T.**
Acute Zinc Toxicity to Rainbow Trout (*Salmo gairdneri*): Confirmation of the Hypothesis that Death is Related to Tissue Hypoxia, W73-11180 5C
- BURTON, W.**
An Improved Ekman-Type Grab, W73-11659 5A
- BUTLER, R. L.**
Fish and Food Organisms in Acid Mine Waters of Pennsylvania, W73-11332 5C
- BUTTON, D. K.**
Continuous Culture of *Rhodotorula rubra*: Kinetics of Phosphate-Arsenate Uptake, Inhibition, and Phosphate-Limited Growth, W73-11574 5A
- BUZAS, M. A.**
Smithsonian Advisory Committee Report on Studies of the Effects of Waste Disposal in the New York Bight, W73-11642 5C
- BYE, P.**
Recent Developments in the Analytical Application of UV Photoelectron Spectroscopy, W73-11489 5A
- BYKOV, V. D.**
Investigation of Seasonal Variability of Runoff on Rivers in the Altay and Sayan Mountain Systems (Issledovaniye vnutrigodovoy neravnomernosti stoka rek Altaya i Sayan), W73-11101 2E
- BYSHOVETS, I. B.**
Use of Digital Computers to Compute Propagation of Flood Waves Along the Cascade of Reservoirs on the Dnieper River (Primeneniye ETsVM diya rascheta rasprostraneniya voln polovodii po kaskadu gidrouzlov na Dnepre), W73-11693 2E
- CAHILL, J. P.**
Lithium in Surficial Materials of the Continuous United States and Partial Data on Cadmium, W73-11268 5B
- CAIRNS, J. JR.**
Acute Zinc Toxicity to Rainbow Trout (*Salmo gairdneri*): Confirmation of the Hypothesis that Death is Related to Tissue Hypoxia, W73-11180 5C
- CALLEY, D. J.**
Apollo Experience Report, Potable Water System, W73-11202 5F
- CAMBRAJ, R. S.**
Trace Elements in the Atmospheric Environment, W73-11299 5A
- CAMFIELD, F. E.**
Hydraulic Model Measurements of Tidal Currents Around Cape Henlopen, Delaware, W73-11203 2L

AUTHOR INDEX

CAMPBELL, J. M.

CAMPBELL, J. M.
Water Sampling Guidelines and Interpretation
of Data,
W73-11205 7A

CAMPBELL, S.
Preliminary Report, (RV Thomas G. Thompson
Cruise 66),
W73-11583 5A

CAMPBELL, W. J.
Towing Icebergs to Irrigate Arid Lands--Manna
or Madness,
W73-11566 6F

CANALE, R. P.
Water Quality Models for Total Coliform,
W73-11135 5B

CANARIO, M. T. JR
Residues of Chlorinated Hydrocarbon Pesticides
in the Northern Quahog (Hard-Shell Clam),
Mercenaria mercenaria-1968 and 1969,
W73-11579 5C

CANNON, R. E.
Pollution Effects on Phycovirus and Host
Algae Ecology,
W73-11635 5C

CAPUZZO, J. M.
The Use of Modern Chromium Accumulations
to Determine Estuarine Sedimentation Rates,
W73-11392 2L

CARCICH, I. G.
Phosphorus in Waste Water,
W73-11592 5D

CARIGNAN, Y. P.
Quantitative Infrared Spectrophotometry of
Organic Nitrate Esters,
W73-11600 5A

CARLSON, R. F.
A Catalog of Hydroclimatological Data for
Alaska's Coastal Zone,
W73-11056 2B

CARPENTER, J. H.
Smithsonian Advisory Committee Report on
Studies of the Effects of Waste Disposal in the
New York Bight,
W73-11642 5C

CARR, P. A.
Investigation of Infrared Anomalies in the Lac
Des Deux Montagnes Area, Quebec,
W73-11541 7B

CARROLL, D. I.
New Picogram Detection System Based on a
Mass Spectrometer With an External Ionization
Source at Atmospheric Pressure,
W73-11608 5A

CARTER, H. O.
Programing Model for Evaluating Economic
and Financial Feasibility of Irrigation Projects
with Extended Development Periods,
W73-11149 3F

CARVER, R. E.
Adsorption Characteristics of Opaline Clays
From the Eocene of Georgia,
W73-11536 2G

CASSELL, E. A.
Design Factors for Effective Settling of Coagulated
Water,
W73-11451 5F

CASTELLI, V. J.

The Thermal Conductivity of Pure Water and
Standard Sea Water as a Function of Pressure
and Temperature: Part II--Pure Water,
W73-11084 2K

CASTLE, R. W.

Oil/Sorbent Harvesting System for Use on Vessels
of Opportunity,
W73-11445 5G

CATOE, C. E.

Remote Sensing Techniques for Detecting Oil
Slicks,
W73-11137 5A

CATTELL, S. A.

The Seasonal Cycle of Vitamin B12 in the
Strait of Georgia, British Columbia,
W73-11578 2L

CAWSE, P. A.

Trace Elements in the Atmospheric Environment,
W73-11299 5A

CERVIONE, M. A. JR

Water Resources Inventory of Connecticut:
Part 6. Upper Housatonic River Basin,
W73-11555 2A

CHADWICK, T. C.

2,4,6-Triphenylpyrlyium Chloride. A New Organic
Analytical Reagent for the Determination
of Certain Anions,
W73-11623 5A

CHAKRABARTI, D. C.

Investigation on Erodibility and Water Stable
Aggregates of Certain Soils of Eastern Nepal,
W73-11272 2J

CHANG, T. P.

Iterative Simulation Algorithm in Reservoir
Systems Operation,
W73-11139 4A

CHANG, W. M.

Analysis of Sea Water by Difference Chromatography. Summary of Progress 1972,
W73-11584 5A

CHATUPA, J.

Application of Regression Analysis to the
Study of Background Variations in Trace Metal
Content of Stream Sediments,
W73-11179 5A

CHAUDHURI, M.

Metal Toxicity to Sewage Organisms, A
Discussion,
W73-11266 5D

CHAUDHURI, N.

A Colorimetric Technique Suggested for
Chemical Oxygen Demand Determination,
W73-11599 5A

CHECK, R. M.

Residues of Chlorinated Hydrocarbon Pesticides
in the Northern Quahog (Hard-Shell Clam),
Mercenaria mercenaria-1968 and 1969,
W73-11579 5C

CHEN, H.

The Bacteriology of the Water Supplies of Rangoon: II. Cool Dry and Hot Dry Seasons,
W73-11630 5C

CHEN, H. S.

The Growth Rate of Ice Crystals: The Properties
of Carbon Dioxide Hydrate A Review of
Properties of 51 Gas Hydrates,
W73-11156 3A

CHENG, J. Y.

A Simple Microscale Vacuum Collector for the
Elution of Closely Situated Spots from Thin-Layer Chromatograms,
W73-11657 5A

CHESSELET, R.

Some Aspects of the Geochemistry of Marine
Aerosols,
W73-11372 2K

CHESTER, R.

Geological, Geochemical and Environmental
Implications of the Marine Dust Veil,
W73-11383 5B

CHESTERS, G.

Mercury Accumulation by *Myriophyllum
Spicatum L.*,
W73-11168 5C

CHUDOBA, J.

Chemical Oxygen Demand of Some
Nitrogenous Heterocyclic Compounds,
W73-11611 5A

CHURCHILL, F. M.

Watershed Research,
W73-11534 2A

CICCIOLI, P.

Improved Double Detection Gas Chromatograph-Mass Spectrometer Interface for the
Analysis of Complex Organic Mixtures,
W73-11663 5A

CICHY, P. T.

Reactor Model Parameters - Two-Phase Reactor
Design Tubular Reactors,
W73-11138 5F

CLARKSON, T. W.

Transfer of Metallic Mercury into the Foetus,
W73-11274 5B

CLINE, J. D.

Oxygen Deficient Conditions and Nitrate
Reduction in the Eastern Tropical North
Pacific Ocean,
W73-11589 5A

COCHRANE, M. W.

Cannery Wastewater Treatment with Rotating
Biological Contactor and Extended Aeration,
W73-11058 5D

COLE, A. L.

Analysis of Lake Erie Wave Pressure Data,
W73-11548 8B

COLE, W.

Apparatus for Treating Sewage,
W73-11231 5D

COMMINGS, A. B.

An Inventory of Suspended Sediment Stations
and Type of Data Analysis for Pennsylvania
Streams, 1947-70,
W73-11083 2J

CONNOR, P. M.

A Continuous-Flow Apparatus for Assessing
the Toxicity of Substances to Marine Animals,
W73-11169 5C

AUTHOR INDEX

DEE, N.

COOKE, W. B. Land Spreading, A Conserving and Non-Polluting Method of Disposing of Oily Wastes, W73-11535	5E	CSUROS, Z. Process for the Removal of Cyanide from Sewage by Means of Formaldehyde, W73-11224	5D	Survey of Water Quality and Sediments in Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York (Appendix to Technical Report No. 14), W73-11109	2K
COOLEY, R. L. Hydrology of Truckee Meadows, Nevada, W73-11430	4B	CULBERTSON, J. K. Sampling Procedures and Problems in Determining Pesticide Residues in the Hydrologic Environment, W73-11660	5A	DAVIES, P. H. Effects of Chemical Variations in Aquatic Environments: Volume III, Lead Toxicity to Rainbow Trout and Testing Application Factor Concept, W73-11076	5C
COOPER, E. L. Fish and Food Organisms in Acid Mine Waters of Pennsylvania, W73-11332	5C	CUMMINS, K. W. Leaf Processing in a Woodland Trout Stream, W73-11112	5B	DAVIS, H. J. Investigation of Polybenzimidazole Hollow Fiber Reverse Osmosis Desalination Membranes, W73-11157	3A
COPE, D. F. Nuclear Dual Purpose Plants in Regional Development, W73-11496	3A	CUMONT, G. Sea Fish Contamination With Mercury (Contamination des poissons de mer par le mercure), W73-11289	5C	DAVIES, J. C. Sublethal Effects of Bleached Kraft Pulp Mill Effluent on Respiration and Circulation in Sockeye Salmon (<i>Oncorhynchus nerka</i>), W73-11615	5C
COPENHAVER, T. W. Numerical Techniques Applied to Particle Deposition During Slot Flow, W73-11697	2J	CUNNINGHAM, J. J. A Rapidly Deployable Oil Containment Boom for Emergency Harbor Use, W73-11439	5G	DAVIES, J. J. Generic Feed Forward Control of Activated Sludge, W73-11362	5D
CORBET, S. A. A Study of a Small Tropical Lake Treated With the Molluscicide Frescon, W73-11614	5C	CUPPERUS, P. Low Cost Multichannel Scanning pH-Stat, W73-11492	5A	DAVIES, R. A. JR Coastal Dynamics along Mustang Island, Texas, W73-11081	2L
CORDS, H. P. Freeze-Free (32 F) Seasons of the Major Basins and Plateaus of Nevada, W73-11218	7C	CUPPETT, V. M. Ferrous Iron and the Growth of Twenty Isolates of Phytophthora Infestans in Synthetic Media, W73-11490	5A	DAWSON, W. A. Measurement of Salt-Wedge Excursion Distance in the Duwamish River Estuary, Seattle, Washington, by Means of the Dissolved-Oxygen Gradient, W73-11564	5B
COURTENAY, W. R. JR Ecological Monitoring of Two Beach Nourishment Projects in Broward County, Florida, W73-11528	2J	DALESICKY, J. Chemical Oxygen Demand of Some Nitrogenous Heterocyclic Compounds, W73-11611	5A	DE, A. A Colorimetric Technique Suggested for Chemical Oxygen Demand Determination, W73-11599	5A
Environmental Effects on Toxaphene Toxicity to Selected Fishes and Crustaceans, W73-11323	5C	DALEY, R. J. A Quantitative, Semiroutine Method for Determining Algal and Sedimentary Chlorophyll Derivatives, W73-11637	5A	DE BRUIN, A. Certain Biological Effects of Lead Upon the Animal Organism, W73-11307	5C
COYNE, R. V. Water Sampling Guidelines and Interpretation of Data, W73-11205	7A	DALMATOV, B. I. Moisture Transfer and Frost Heave in Loams, W73-11193	2G	DEAN, G. W. Programming Model for Evaluating Economic and Financial Feasibility of Irrigation Projects with Extended Development Periods, W73-11149	3F
CRAFT, T. F. Dyestuff Color Removal by Ionizing Radiation and Chemical Oxidation, W73-11329	5D	DAMS, R. Areawide Trace Metal Concentrations Measured by Multielement Neutron Activation Analysis - A One Day Study in Northwest Indiana, W73-11278	5B	DEAN, R. B. The Case Against Mercury, W73-11303	5C
CRANE, R. A. Auto Exhaust - Lead Vs Aromatics, W73-11301	5A	DAMSCHEIDER, N. Softening A 46-Grain Water, W73-11665	5F	DESSARD, H. V. Seasonal Emergence of Some High Arctic Chironomidae (Diptera), W73-11148	2I
CRAWFORD, M. D. Infant Mortality and Hardness of Local Water Supplies, W73-11144	5C	DARBY, R. L. Operation of the Analytical Methodology Information Center, W73-11336	5A	DARBY, R. L. Operation of the Analytical Methodology Information Center, W73-11336	5A
CRESS, R. H. A Small Vacuum Oil Skimming System, W73-11436	5G	DASCHMANN, R. F. Environmental Conservation, W73-11170	6G	DEANER, D. G. Effect of Chlorine on Fluorescent Dyes, W73-11597	5C
CREW, A. Water Supply Improvements Feature New Coagulator, W73-11315	5F	DAVIES, D. Characteristics and Environmental Quality of Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York, W73-11108	2K	DECHTIAR, A. O. Parasites of Fish from Lake of the Woods, Ontario, W73-11172	2I
CRONBERG, G. Planktonic Changes Following the Restoration of Lake Trumen, Sweden, W73-11639	5G	DAVIES, N. An Environmental Evaluation System for Water Resource Planning, W73-11151	6A	DEE, N.	
CROSS, R. Use of Fire Streams to Control Floating Oil, W73-11435	5G				

AUTHOR INDEX

DEMichele, E.

DEMichele, E.
Pollution Effects on Phycovirus and Host
Algae Ecology,
W73-11635

5C

DEMPSTER, G. R. JR.

Radiouclides in Transport in the Columbia
River from Pasco to Vancouver, Washington,
W73-11549

5B

DERR, V. E.

Applications of Remote Sensing Techniques to
Buoy-Based Environmental Data Gathering,
W73-11631

5A

DESAI, M. V. M.

Organic Materials in the Marine Environment
and the Associated Metallic Elements,
W73-11184

5B

DESHPANDE, P. B.

Numerical Techniques Applied to Particle
Deposition During Slot Flow,
W73-11697

2J

DESIDERIO, D. M.

Comparison of Selective Ion Monitoring and
Repetitive Scanning During Gas Chromatog-
raphy-Mass Spectrometry,
W73-11493

5A

DEWET, J. M. J.

The Origin and Domestication of Sorghum
Bicolor,
W73-11561

3F

DICKEY, P. A.

Abnormal Pressures in Deep Wells of
Southwestern Louisiana,
W73-11464

8E

DICKSTEIN, I. L.

Improved Water at Lower Cost Produced with
Coagulant Aid,
W73-11666

5F

DIGHTON, J. C.

Tritium Concentration of a Variety of Water
Samples: Fifth Listing,
W73-11104

5B

DJURIE, D.

Environmental Contamination by Lead from a
Mine and Smelter,
W73-11267

5C

DOBBS, T. L.

Financing Private Water Resource Develop-
ment: Analysis of a State Loan Program,
W73-11686

3F

DOLAN, F. X.

Development of a Mobile System for Cleaning
Oil-Contaminated Beaches,
W73-11064

5G

DOLAR, S. G.

Mercury Accumulation by *Myriophyllum*
Spicatum L.,
W73-11168

5C

DOLLEAR, F. G.

Mass Spectrometric Identification of Some bis-
2,4-Dinitrophenylhydrazones,
W73-11487

5A

DORRIER, J. S.

Standard Dispersant Effectiveness and Toxicity
Tests,
W73-11442

5A

DOSTAL, K. A.

Cannery Wastewater Treatment with Rotating
Biological Contactor and Extended Aeration,
W73-11058

5D

DOTSON, G. K.

Land Spreading, A Conserving and Non-Pollut-
ing Method of Disposing of Oily Wastes,
W73-11535

5E

DOUDOROFF, P.

Development of Dissolved Oxygen Criteria for
Freshwater Fish,
W73-11327

5C

DOWNEY, L. A.

Response of Relative Water Content in Zea
Mays L. to Changes of Potential in the Rhizo-
sphere and Atmosphere,
W73-11145

3F

DRAYSON, S. R.

The Inference of Atmospheric Ozone Using
Satellite Nadir Measurements in the 1042/CM
Band,
W73-11400

7B

DREGNE, H. E.

Short-Term Effects of Irrigation with High
Sodium Waters,
W73-11111

3C

DROBNY, N.

An Environmental Evaluation System for
Water Resource Planning,
W73-11151

6A

DROZDOVA, T. V.

Conditions of Preservation of Chlorophyll,
Phaeophytin, and Humic Substances in Black
Sea Sediments (Usloviya sokhranosti
khlorofilla, feofitina i guminovykh veshchestv
v otlozhennyakh Chernogo morya),
W73-11411

2J

DUDLEY, N. J.

Stochastic Reservoir Management and System
Design for Irrigation,
W73-11152

3F

DUKE, K.

An Environmental Evaluation System for
Water Resource Planning,
W73-11151

6A

DUNKER, S. S.

Continuous Culture of *Rhodotorula rubra*:
Kinetics of Phosphate-Arsenate Uptake, Inhibi-
tion, and Phosphate-Limited Growth,
W73-11574

5A

DUSZA, Z.

Process for the Removal of Cyanide from
Sewage by Means of Formaldehyde,
W73-11224

5D

DUTKA, B. J.

Biological Oxidation of the Hydrocarbons in
Aqueous Phase,
W73-11132

5B

DUNN, J. C.

Determination of Carbohydrate in Lake Sediment
by a Modified Phenol-Sulfuric Acid
Method,
W73-11482

5A

DYKES, J. R.

Isolation of Salmonellae from Moderately Pol-
luted Waters,
W73-11134

5A

DUTTON, R. D.

On Large Diversions from the Northwest--Nor-
mal and High-Flow Years,
W73-11685

6A

DZIDIC, I.

New Picogram Detection System Based on a
Mass Spectrometer With an External Ionization
Source at Atmospheric Pressure,
W73-11608

5A

EBING, W.

Clean-Up of Crude Extracts Containing Pesti-
cide Residues by an Atomic Apparatus Bas-
ing Upon the Principle of Sweep Co-Distilla-
tion, (Reinigung Pesticidextrakte Mit einer Automatisch Ar-
beitenden Rohrextakte Mit Einer Automatisch Ar-
beitenden Apparatur Nach Dem Prinzip der
Kombinierten Spülund Codestillation (Sweep
Codistillation)),
W73-11124

5A

ECKBLAD, J. W.

Population Studies of three Aquatic Gastropods
in an Intermittent Backwater,
W73-11494

5A

EDDLEMAN, L.

The Response of Native Montana Grasses to
Soil Water Stress,
W73-11429

2I

EDWARDS, A. E. J.

Salinity Control on a Borehole Source in
Bunter Sandstone,
W73-11469

4B

EICHHOLZ, G. G.

Dyestuff Color Removal by Ionizing Radiation
and Chemical Oxidation,
W73-11329

5D

EISNER, S.

Water Purification With Porous Abrasives,
W73-11228

5D

ELFGREN, L.

Torsional Stiffness of Reinforced Concrete
Members Subjected to Pure Torsion,
W73-11519

8F

ELLIASSEN, R.

Design Factors for Effective Settling of Coagu-
lated Water,
W73-11451

5F

ELLIOTT, L.

Movement of Acarol and Terbicil Pesticides
During Displacement Through Columns of
Wabasso Fine Sand,
W73-11537

5B

ELLIS, M. J.

Groundwater Levels in Nebraska, 1972,
W73-11120

4B

ELLY, C. T.

Dithizone Procedure for Mercury Analysis,
W73-11306

5A

ELPHINGSTONE, G.

Computer Program System for Aerotriangula-
tion,
W73-11518

7C

EMMANUEL, C. B.

Applications of Remote Sensing Techniques to
Buoy-Based Environmental Data Gathering,
W73-11631

5A

AUTHOR INDEX

FRANK, R.

- EMRICH, G. H.**
Hydrogeologic Considerations for Sealing Coal Mines,
W73-11675 5G
- The Need for Hydrogeologic Evaluations in a Mine Drainage Abatement Program: A Case Study, Toms Run, Clarion County, Pennsylvania,
W73-11674 5G
- ENGELBRECHT, R. S.**
Metal Toxicity to Sewage Organisms, A Discussion,
W73-11266 5D
- ENGHOLDT, R. K.**
Method and Apparatus for Detecting the Hardness Level of Water,
W73-11227 7B
- ENOS, J. F.**
Research on Reverse Osmosis Membranes for Purification of Wash Water at Sterilization Temperature (165°F),
W73-11159 3A
- EPSHTEYN, O. G.**
Upper Permian Glaciomarine Deposits in the Kolyma River Basin (Verkhnepermskiye ledovo-morskiye otlozheniya basseyna istokov r. Kolomyi),
W73-11103 2J
- ERDMANN, D. E.**
Water Analysis,
W73-11285 2K
- ERICKSON, L. E.**
Nonlinear Parameter Estimation in Water Quality Modeling,
W73-11361 5B
- Supplementation of Missing Values in Water Quality Data,
W73-11687 5G
- EVANS, R. L.**
Mercury in Public Sewer Systems,
W73-11585 5D
- EVERHART, W. H.**
Effects of Chemical Variations in Aquatic Environments: Volume I, Biota and Chemistry of Piceance Creek,
W73-11074 5C
- Effects of Chemical Variations in Aquatic Environments: Volume II, Toxic effects of aqueous aluminum to rainbow trout,
W73-11075 5C
- Effects of Chemical Variations in Aquatic Environments: Volume III, Lead Toxicity to Rainbow Trout and Testing Application Factor Concept,
W73-11076 5C
- EVETT, W. W.**
Hydrology and Water Resources Development in Nepal,
W73-11401 4A
- FAN, C-Y.**
Ultra High Rate Filtration of Activated Sludge Plant Effluent,
W73-11337 5D
- FAN, L. T.**
Nonlinear Parameter Estimation in Water Quality Modeling,
W73-11361 5B
- Supplementation of Missing Values in Water Quality Data,
W73-11687 5G
- FANCHER, H. R. JR**
Fluvial Sediment in Sixmile Creek Subwatershed 6, Near Chismville, Arkansas,
W73-11082 2J
- FARMER, D. M.**
National Meat-Packaging Waste Management Research and Development Program,
W73-11440 5D
- FARRINGTON, J. W.**
Petroleum Hydrocarbons and Fatty Acids in Wastewater Effluents,
W73-11575 5B
- FAULKNER, M. E.**
Soil Physical Factors Affecting Root Morphology and Stability of Scots Pine on Upland Heaths,
W73-11173 4A
- FEDOROVA, I. S.**
Investigation of Seasonal Variability of Runoff on Rivers in the Altay and Sayan Mountain Systems (Issledovaniye vnutrigodovoy neravnomernosti stoka rek Altaya i Sayan),
W73-11101 2E
- FELDT, L. E.**
Spring Phytoplankton Abundance and Productivity in Grand Traverse Bay, Lake Michigan, 1970,
W73-11629 5B
- FELTZ, H. R.**
Sampling Procedures and Problems in Determining Pesticide Residues in the Hydrologic Environment,
W73-11660 5A
- FERGUSON, J.**
Volcanic Exhalations and Metal Enrichments at Matupi Harbor, New Britain, T.P.N.G.,
W73-11292 5B
- FERRAR, T. A.**
Progressive Taxation as a Policy for Water Quality Management,
W73-11147 5G
- FERRARA, T. C.**
Public Participation in Urban Water Planning,
W73-11257 6B
- FISHER, J. W.**
Design, Structural Details, and Discontinuities in Steel,
W73-11524 8G
- FISHMAN, M. J.**
Determination of Total Chromium in Fresh Waters by Atomic Absorption,
W73-11295 5A
- The Use of Atomic Absorption for Analysis of Natural Waters,
W73-11291 5A
- Water Analysis,
W73-11285 2K
- FISK, D. M.**
Physical-Chemical Oceanographic Data from the North Pacific Ocean and Bering Sea, 1971,
W73-11595 5A
- FLANNAGAN, J. F.**
An Improved Ekman-Type Grab,
W73-11659 5A
- FLEMING, R. F.**
Sublethal Effects of Baltimore Harbor Water on the White Perch, *Morone americana*, and the Hogchoker, *Trinectes maculatus*,
W73-11652 5C
- FLETCHER, A. N.**
High-Temperature Contact Nucleation of Supercooled Water by Organic Chemicals and Appendix of Compounds Tested,
W73-11699 3B
- FLETCHER, K.**
Application of Regression Analysis to the Study of Background Variations in Trace Metal Content of Stream Sediments,
W73-11179 5A
- FLETCHER, R. I.**
Apparatus for Handling Sewage,
W73-11242 5D
- FLYNN, W. W.**
A Solvent Extraction Method for the Determination of Phosphorus-32 in Sea Water,
W73-11643 5A
- FOGET, C. R.**
Oil/Sorbent Harvesting System for Use on Vessels of Opportunity,
W73-11445 5G
- FOLEY, J. W.**
Multilevel Control of Multipollutant System,
W73-11363 5G
- FOMINA, L. S.**
Role of Iron Sulfides in the Accumulation of Trace Elements in Black Sea Sediments (Rol' sul'fidov zheleza pri nakoplenii mikroelementov v osadkakh Chernogo morya),
W73-11409 2J
- FORDHAM, J. W.**
Hydrology of Truckee Meadows, Nevada,
W73-11430 4B
- FOREMAN, J. W.**
Evaluation of Pollution Abatement Procedures Moraine State Park,
W73-11062 5G
- FORSBERG, C. R.**
Polarographic Method for Nitrate and Dissolved Oxygen Analyses,
W73-11662 5A
- FOX, W. T.**
Coastal Dynamics along Mustang Island, Texas,
W73-11081 2L
- FRANCO, J. J.**
Effects of Submerged Silts in the St. Clair River,
W73-11089 8B
- FRANK, F. J.**
Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington,
W73-11204 5B
- Groundwater Data in the Corvallis-Albany Area, Central Willamette Valley, Oregon,
W73-11093 4B
- FRANK, R.**
Mercury, DDT, and PCB in Harbour Seals (*Phoca vitulina*) From the Bay of Fundy and Gulf of Maine,
W73-11577 5C

AUTHOR INDEX

FRANK, R.

Mercury in Harbour Porpoises (<i>Phocoena phocoena</i>) From the Bay of Fundy Region, W73-11588	5C	GASKIN, D. E. Mercury, DDT, and PCB in Harbour Seals (<i>Phoca vitulina</i>) From the Bay of Fundy and Gulf of Maine, W73-11577	5C	GLOVER, J. E. Effects of Submerged Sills in the St. Clair River, W73-11089	5B
FRANZINI, J. B. Urbanization's Drainage Consequence, W73-11254	4C	Mercury in Harbour Porpoises (<i>Phocoena phocoena</i>) From the Bay of Fundy Region, W73-11588	5C	GLOVER, W. D. JR Lead Emissions from Incinerated Sewage Sludge Detected on Tree Foliage, W73-11302	5A
FREEMAN, H. C. Total Mercury and Methylmercury Content of the American Eel (<i>Anguilla rostrata</i>), W73-11576	6C	GAUGER, S. E. Aesthetic Preference for Water Resource Projects: An Application of Q Methodology, W73-11684	6B	GOELDNER, R. W. Flash Evaporator Structure, W73-11358	3A
FREEMAN, R. A. Effects of Chemical Variations in Aquatic Environments: Volume II, Toxic effects of aqueous aluminum to rainbow trout, W73-11075	5C	GAZOST, A. De-Oiling of Polluted Waters, W73-11226	5D	GOFF, D. R. The Role of Nitrogen in the Aquatic Environment, W73-11640	5C
FREITAG, R. Fallout of Sodium Sulphate near a Kraft Mill, W73-11175	5A	GEHM, H. State-of-the-Art Review of Pulp and Paper Waste Treatment, W73-11080	5D	GOLDBERG, E. D. Man's Role in the Major Sedimentary Cycle, W73-11382	5B
FRIEL, J. V. Control of Hazardous Chemical Spills by Physical Barriers, W73-11338	5G	GELBLUM, P. G. Softening of Sea Water By Addition of Barium Carbonate and CO ₂ , W73-11236	5F	GOODIN, J. R. Ecological and Physiological Implications of Greenbelt Irrigation - Phase I, W73-11424	5D
FROMMER, M. A. The Mechanism of Formation of 'Skinned' Type Membranes and Their Characterization, W73-11153	3A	Softening of Sea Water by Addition of Barium Carbonate and Mineral Acid, W73-11237	5F	GOTOH, Y. Phenylmercuric Acetate: Metabolic Conversion by Microorganisms, W73-11187	5B
FUKUDA, Y. Survival Potential of F1 Hybrids Among Salmonid Fishes, W73-11653	8I	GELIN, C. Planktonic Changes Following the Restoration of Lake Trumen, Sweden, W73-11639	5G	GOUW, T. H. Simulated Distillation of Narrow, High Boiling Hydrocarbon Fractions, W73-11613	5A
GALE, N. L. The Lead Industry as a Source of Trace Metals in the Environment, W73-11269	5B	GERLOFF, G. C. Plant Analysis for Nutrient Assay of Natural Waters, W73-11057	5C	GRAHAM, J. L. Aerobic Secondary Treatment of Plywood Glue Wastes, W73-11065	5D
GAMMON, J. The Northern Maine Regional Treatment System, W73-11079	5D	GIAM, C. S. DDT, DDE, and Polychlorinated Biphenyls in Biota From the Gulf of Mexico and Caribbean Sea-1971, W73-11580	5B	GRAOVAC-LEPOSAVIC, L. Environmental Contamination by Lead from a Mine and Smelter, W73-11267	5C
GANAPATHY, S. Organic Materials in the Marine Environment and the Associated Metallic Elements, W73-11184	5B	GIBSON, J. W. Photographic Water Conservation and Reclamation Processes Study, W73-11403	5A	GRAY, C. B. J. A Quantitative, Semiroutine Method for Determining Algal and Sedimentary Chlorophyll Derivatives, W73-11637	5A
GANGULY, A. K. Organic Materials in the Marine Environment and the Associated Metallic Elements, W73-11184	5B	GIBSON, W. Spray Freezing, Decanting, Melting and Hydrolysis as Related to Secondary Refrigerant Desalting, W73-11158	3A	GRECO, M. Acquisition and Reduction of Gas Chromatographic Data Using a Computer, W73-11491	5A
GANNON, J. J. Water Quality Models for Total Coliform, W73-11135	5B	GILBERT, R. Drainings of Ice-Dammed Summit Lake, British Columbia, W73-11547	2E	GREEN, J. A Study of a Small Tropical Lake Treated With the Molluscicide Frescon, W73-11614	5C
GARDNER, D. Distribution of Dissolved Mercury in the Irish Sea, W73-11293	5B	GILL, W. N. Dispersion and Miscible Displacement, W73-11167	3A	GREENWOOD, M. R. Transfer of Metallic Mercury into the Foetus, W73-11274	5B
GARDNER, G. R. Copper Induced Lesions in Estuarine Teleosts, W73-11616	5C	GLADWELL, J. S. Research and Development in Water Resources, Water Resources Research, Its Role in the Total R and D Spectrum, W73-11341	6B	GRICE, G. D. Chlorinated Hydrocarbons in Open-Ocean Atlantic Organisms, W73-11377	5B
GARDNER, M. J. Infant Mortality and Hardness of Local Water Supplies, W73-11144	5C	GLORIOT, T. L. Simultaneous, Multiple-Level Release from Stratified Reservoirs, W73-11567	8B	GRIGOR'YEVA, L. K. Investigation of the Dynamics and Calculation of the Losses of Spring Runoff in a Small River Basin (Issledovaniye dinamiki i raschet poteri vesennego stoka v malom rechnom basseyne), W73-11690	2E
GARRETT, W. D. Impact of Natural and Man-Made Surface Films on the Properties of the Air-Sea Interface, W73-11371	5B				

AUTHOR INDEX

HEGG, B.

GRITTON, E. C.		
A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. V, Jamaica Bay Rainstorms, W73-11351	5B	
GROSS, H.		
Investigation of Infrared Anomalies in the Lac Des Deux Montagnes Area, Quebec, W73-11541	7B	
GROSS, M. G.		
Characteristic and Environmental Quality of Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York, W73-11108	2K	
Survey of Water Quality and Sediments in Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York (Appendix to Technical Report No. 14), W73-11109	2K	
GROSSMAN, G.		
Ion Transport Through Layered Ion Exchange Membranes, W73-11160	3A	
Membrane Fouling in Electrodialysis: A Model and Experiments, W73-11163	3A	
Spray Freezing, Decanting, Melting and Hydrolysis as Related to Secondary Refrigerant Desalting, W73-11158	3A	
GSCHWIND, J.		
Leachate Quality from Acidic Mine Spoil Fertilized with Liquid Digested Sewage Sludge, W73-11680	5G	
GUENTHNER, H. R.		
Freeze-Free (32 F) Seasons of the Major Basins and Plateaus of Nevada, W73-11218	7C	
GULLVAG, B. M.		
Lead Accumulation Within Nuclei of Moss Leaf Cells, W73-11276	5E	
GUPTA, R. N.		
Fertilizer Response to the Physical Effects of Soil Compaction, W73-11280	3F	
GURSKIY, YU. N.		
Conditions of Preservation of Chlorophyll, Pheophytin, and Humic Substances in Black Sea Sediments (Usloviya sokhrannosti klorofilla, feofitsina i guminovykh veshchestv v otlozheniyakh Chernogo morya), W73-11411	2J	
GUTENTAG, E. D.		
Ground Water in Finney County, Southwestern Kansas, W73-11106	7C	
GUYMON, G. L.		
Finite Element Solution for General Fluid Motion, W73-11091	8B	
GVOZDETSKIY, N. A.		
Karst Landscapes and Karst Forms (Karstovyye landshafty i tipy karsta), W73-11102	4A	
HABASHI, F.		
Oxidation of Copper (II) Selenide by Thiobacillus Ferrooxidans, W73-11171	5C	
HABLA, H.		
Alpha-Al2O3 as an Adsorbent in Thin-Layer Chromatography, W73-11128	5A	
HAHN, J.		
Nitrous Oxide in Air and Sea Water over the Atlantic Ocean, W73-11370	5B	
HAIMES, Y. Y.		
Multilevel Control of Multipollutant System, W73-11363	5G	
HALES, D. C.		
Fish and Food Organisms in Acid Mine Waters of Pennsylvania, W73-11332	5C	
HALL, F. F.		
Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering, W73-11631	5A	
HALL, J. D.		
Effects of Logging on Growth of Juvenile Coho Salmon, W73-11433	5C	
HALLIGAN, J. E.		
Removal of Oil From Water Surfaces By Sorption on Unstructured Fibers, W73-11586	5G	
HALLSWORTH, E. G.		
The Heavy Metal Content of Rainfall in the East Midlands, W73-11648	5A	
HAMILTON, D. H.		
Ground Rupture in the Baldwin Hills, W73-11206	5E	
HAMNER, N. E.		
A Literature Survey—Performance of Exceptional Metals in Corrosive Environments, W73-11479	8G	
HAMPTON, B. B.		
Annual Compilation and Analysis of Hydrologic Data for Urban Studies in the Fort Worth, Texas, Metropolitan Area, 1971, W73-11215	4C	
HANAN, J. J.		
Water Potentials in Nonwilted Dianthus Grown in Different Nutrient Solution Concentrations, W73-11191	2I	
HANFORD, W. E.		
Water Decomposition Apparatus, W73-11234	5F	
HANKIN, L.		
Lead Emissions from Incinerated Sewage Sludge Detected on Tree Foliage, W73-11302	5A	
HANKS, A. R.		
DDT, DDE, and Polychlorinated Biphenyls in Biota From the Gulf of Mexico and Caribbean Sea—1971, W73-11580	5B	
HANSMANN, E. W.		
Effects of Logging on Periphyton in Coastal Streams of Oregon, W73-11582	5C	
HARDER, W.		
Low Cost Multichannel Scanning pH-Stat, W73-11492	5A	
HARGRAVE, B. T.		
A Comparison of Benthic Microalgal Production Measured by C-14 and Oxygen Methods, W73-11658	5A	
HARLAN, J. R.		
The Origin and Domestication of Sorghum Bicolor, W73-11561	3F	
HARMSEN, L.		
Bathymetric Reconnaissance of Weber Reservoir, Mineral County, Nevada, W73-11220	7C	
Bathymetric Reconnaissance of Wild Horse Reservoir, Elko County, Nevada, W73-11219	7C	
HARRIS, R. F.		
Measurement of Exchangeable Inorganic Phosphate in Lake Sediments, W73-11596	5A	
HARRISON, P. R.		
Areawide Trace Metal Concentrations Measured by Multielement Neutron Activation Analysis - A One Day Study in Northwest Indiana, W73-11278	5B	
HARVEY, G. R.		
Adsorption of Chlorinated Hydrocarbons from Seawater by a Crosslinked Polymer, W73-11443	5A	
Chlorinated Hydrocarbons in Open-Ocean Atlantic Organisms, W73-11377	5B	
HASANUDDIN, S. K.		
Recent Developments in the Analytical Application of UV Photoelectron Spectroscopy, W73-11489	5A	
HASTINGS, L.		
Fallout of Sodium Sulphate near a Kraft Mill, W73-11175	5A	
HAUSCHILD, W. L.		
Radionuclides in Transport in the Columbia River from Pasco to Vancouver, Washington, W73-11549	5B	
HAVILICEK, J.		
Behaviour of Fine Sands and Silts During the Rise of Ground-Water Level, W73-11194	2G	
HAYES, D. W.		
Multi-Element Neutron Activation Analysis of Sediment Using a Californium-252 Source, W73-11644	5A	
HEGG, B.		
Water Quality Investigations: Souris River Basin, North Dakota, 1969, W73-11115	5B	

AUTHOR INDEX

HEIDEL, R. H.

Precision and Detection Limits of Cadmium, Manganese, Cobalt, and Nickel in Sulfides by Electron Microprobe Analysis,
W73-11178

5A

HEINLE, D. R.

Sublethal Effects of Baltimore Harbor Water on the White Perch, *Morone americana*, and the Hogchoker, *Trinectes maculatus*,
W73-11652

5C

HEIP, C.

Partitioning of a Brackish Water Habitat by Copepod Species,
W73-11130

5A

HELENELUND, K. V.

Pore Pressure Measurements in Aelotropic Peat,
W73-11195

2G

HENDRICKS, A. C.

Nutrient Ratio Variation in Reservoir Sediments,
W73-11591

5B

HENNING, J. L. JR

Skimming Device for use on a Liquid Surface,
W73-11233

5D

HENRY, G.

The Development and Demonstration of an Underwater Oil Harvesting Technique,
W73-11063

5G

HERMAN, M. W.

Filter Washing Goes Modern,
W73-11448

5F

HERREMA, D. J.

Ecological Monitoring of Two Beach Nourishment Projects in Broward County, Florida,
W73-11528

2J

HERSTUS, J.

Influence of Weathering on Effective Values of Shear Strength of Miocene Clay,
W73-11196

2K

HERZEL, F.

Organochlorine Insecticides in Surface Waters in Germany-1970 and 1971,
W73-11628

5C

HETLING, L. J.

Phosphorus in Waste Water,
W73-11592

5D

HEWES, F. W.

Four Phenomena Affecting Cathodic Protection and Corrosion Rates,
W73-11475

8G

HEYSER, W. H.

Vacuum Skimming Apparatus for Removing Liquid Contaminants Floating in Confined Bodies of Water,
W73-11232

5G

HICKMAN, C. L. IV

Quantitative Infrared Spectrophotometry of Organic Nitrate Esters,
W73-11600

5A

HIGER, A. L.

Applications of Multispectral Remote Sensing Techniques to Hydrobiological Investigations In Everglades National Park,
W73-11553

7B

HILER, E. A.

Crop Response to Trickle and Subsurface Irrigation,
W73-11513

3F

HILTZ, R. H.

Control of Hazardous Chemical Spills by Physical Barriers,
W73-11338

5G

HIMEL, C. M.

Fluorescent Probes in the Detection of Insecticides in Water,
W73-11061

5A

HINE, R. B.

Influence of Soil Temperature and Moisture on Survival and Growth of Strands of *Phytomotrichum omnivorum*,
W73-11248

3F

HINSHAW, R. N.

Pollution as a Result of Fish Cultural Activities,
W73-11077

5B

HIRSCH, R.

Natural Resource Information System Remote Sensing Studies,
W73-11571

7B

HOFFMAN, H. W.

Tube Identifier,
W73-11155

3A

HOGUE, G. B.

Ice Forces on Vertical Piles,
W73-11538

8B

HOITOMT, M.

All-Position Production Welding with Flux-Cored Gas-Shielded Electrodes,
W73-11501

8C

HOLDRENET, M.

Mercury, DDT, and PCB in Harbour Seals (*Phoca vitulina*) From the Bay of Fundy and Gulf of Maine,
W73-11577

5C

HOLLIS, G. E.

The Estimation of the Hydrologic Impact of Urbanization: An Example of the Use of Digital Simulation in Hydrology,
W73-11259

4C

HOLMES, J. W.

The Environmental Tritium Concentration of Underground Water and Its Hydrological Interpretation,
W73-11544

2F

HOLT, C. L. R. JR

Ground-Water Quality in Wisconsin Through 1972,
W73-11568

2F

HOPEMAN, A. R. JR

An Economic Analysis of Flood Damage Reduction Alternatives in the Minnesota River Basin,
W73-11055

6F

HORNE, D. A.

Total Mercury and Methylmercury Content of the American Eel (*Anguilla rostrata*),
W73-11576

6C

HORNE, D. M.

Vacuum Skimming Apparatus for Removing Liquid Contaminants Floating in Confined Bodies of Water,
W73-11232

5G

HORNING, E. C.

New Picogram Detection System Based on a Mass Spectrometer With an External Ionization Source at Atmospheric Pressure,
W73-11608

5A

HORNING, M. G.

New Picogram Detection System Based on a Mass Spectrometer With an External Ionization Source at Atmospheric Pressure,
W73-11608

5A

HORNSBY, A. G.

Prediction Modeling for Salinity Control in Irrigation Return Flows,
W73-11441

5G

HORTON, A. D.

Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection,
W73-11606

5A

HOSFORD, H. W.

External Corrosion of Buried Ferrous Pipelines/1,
W73-11467

8G

HOWARD, F. O.

Leaf Processing in a Woodland Trout Stream,
W73-11112

5B

HOWELL, B. F.

Sand Movement Along Carmel River State Beach, Carmel, California,
W73-11557

2L

HOWELL, T. A.

Crop Response to Trickle and Subsurface Irrigation,
W73-11513

3F

HOWELL, W. E.

The Impact of Weather Modification on U.S. Planning for the Rio Colorado and Rio Grande,
W73-11505

3B

HRUTFIORD, B. F.

Steam Stripping Odorous Substances from Kraft Effluent Streams (SEKOR),
W73-11060

5D

HUBBS, C.

Some Thermal Consequences of Environmental Manipulations of Water,
W73-11355

5C

HUGGINS, L. F.

Hydraulics of Shallow Flows Over Stable Eroded Sand Surfaces Defined by Area Spectra,
W73-11192

2A

HUGHES, D. M.

Hydrologic Records for Volusia County, Florida: 1971-72,
W73-11399

7C

HUGHES, M. W.

Tritium Concentration of a Variety of Water Samples: Fifth Listing,
W73-11104

5B

AUTHOR INDEX

KAMINSKY, E. L.

HULBERT, G. C.			
A Study of the Flint River, Michigan, as it Relates to Low-Flow Augmentation,			
W73-11207	5G		
HUMMER, C. W. JR			
Corrosion of Metals in Tropical Environments-Copper and Wrought Copper Alloys,			
W73-11455	8G		
HUNDING, C.			
A Comparison of Benthic Microalgal Production Measured by C-14 and Oxygen Methods,			
W73-11658	5A		
HUNT, P. C.			
The Food of Brown Trout in Llyn Alaw, Anglesey, North Wales,			
W73-11354	2I		
HUNTER, R. E.			
The Northern Maine Regional Treatment System,			
W73-11079	5D		
HUTCHINSON, R. D.			
Ground-water Basic Data of Cavalier and Pembinia Counties,			
W73-11397	4B		
HUTCHISON, I. P. G.			
A Mathematical Model to Aid Management of Outflow from the Okavango Swamp, Botswana,			
W73-11543	6A		
HWANG, C. P.			
Polarographic Method for Nitrate and Dissolved Oxygen Analyses,			
W73-11662	5A		
HYNDSHAW, A. Y.			
Activated Carbon for Water Treatment,			
W73-11352	5F		
IIJIMA, T.			
Studies on Schistosomiasis in Mekong Basin: II. Malacological Investigations on Human Schistosoma from Laos,			
W73-11633	5C		
ILLSTON, J. M.			
Internal Cracking in Reinforced Concrete Members,			
W73-11523	8F		
INGRAHAM, W. J. JR			
Physical-Chemical Oceanographic Data from the North Pacific Ocean and Bering Sea, 1971,			
W73-11595	5A		
ISARD, W.			
Ecologic-Economic Analysis for Regional Development. Some Initial Explorations with Particular Reference to Recreational Resource Use and Environmental Planning,			
W73-11176	6B		
ISHIDA, K.			
Mercury, DDT, and PCB in Harbour Seals (<i>Phoca vitulina</i>) From the Bay of Fundy and Gulf of Maine,			
W73-11577	5C		
Mercury in Harbour Porpoises (<i>Phocoena phocoena</i>) From the Bay of Fundy Region,			
W73-11588	5C		
ISYAR, Y.			
Programing Model for Evaluating Economic and Financial Feasibility of Irrigation Projects with Extended Development Periods,			
W73-11149	3F		
IWANAGO, P. M.			
Effects of Logging on Growth of Juvenile Coho Salmon,			
W73-11433	5C		
IZRAEL', YU. A.			
Preservation of Lake Baykal (Ob okhrane ozera Baykal),			
W73-11407	5C		
JACKIM, E.			
Influence of Lead and Other Metals on Fish Delta-Aminolevulinic Dehydrase Activity,			
W73-11646	5A		
JACKSON, R.			
Peak Load Pricing Model of an Electric Utility Using Pumped Storage,			
W73-11146	6A		
JACKSON, W. L.			
The Evolving Role of the Federal Government in the Management of Lake Michigan,			
W73-11247	6E		
JAFFE, M.			
Investigation of Polybenzimidazole Hollow Fiber Reverse Osmosis Desalination Membranes,			
W73-11157	3A		
JAYROE, R. R. JR			
Unsupervised Spatial Clustering with Spectral Discrimination,			
W73-11116	7C		
JEBENS, H. J.			
A Flow Proportional Composite Sampler,			
W73-11463	5A		
JENNETT, J. C.			
Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri,			
W73-11271	5C		
The Lead Industry as a Source of Trace Metals in the Environment,			
W73-11269	5B		
JEPSON, C. A.			
H2S Removal from Water Without Air Pollution,			
W73-11314	5F		
JERNELOV, A.			
Mercury-A Case Study of Marine Pollution,			
W73-11375	5B		
JOHANSSON, L. N.			
Steam Stripping Odorous Substances from Kraft Effluent Streams (SEKOR),			
W73-11060	5D		
JOHANSSON, N.			
Low pH Values Shown to Affect Developing Fish Eggs (<i>Brachydanio rerio Ham.-Buch.</i>),			
W73-11651	5C		
JOHN, W.			
Diurnal Variation of Aerosol Trace Element Concentrations in Livermore, California,			
W73-11277	5B		
JOHNSON, A. E.			
Probabilistic Short-Term River Yield Forecasts,			
W73-11366	4A		
JOHNSON, N. A.			
Groundwater Data in the Corvallis-Albany Area, Central Willamette Valley, Oregon,			
W73-11093	4B		
JOHNSON, R. F.			
Removal of Oil From Water Surfaces By Sorption on Unstructured Fibers,			
W73-11586	5G		
JOHNSON, S. L.			
Effects of Urbanization on Floods in the Houston, Texas, Metropolitan Area,			
W73-11402	4C		
JOHNSON, W. K.			
Public Participation in Urban Water Planning,			
W73-11257	6B		
JOHNSTON, W. F.			
An Individual Approach to Independent Computer Survey,			
W73-11512	7C		
JONES, A. H.			
Acute Zinc Toxicity to Rainbow Trout (<i>Salmo gairdneri</i>): Confirmation of the Hypothesis that Death is Related to Tissue Hypoxia,			
W73-11180	5C		
JONES, J. W.			
The Food of Brown Trout in Llyn Alaw, Anglesey, North Wales,			
W73-11354	2I		
JONES, R.			
Anodic Stripping Voltammetry at a Tubular Mercury-Covered Graphite Electrode,			
W73-11484	5A		
JONES, R. D.			
Activated Sludge Sewage Treatment Process and System,			
W73-11239	5D		
JORDAN, R. A.			
An In Situ Evaluation of Nutrient Effects in Lakes,			
W73-11070	5C		
JORGENSEN, J. C.			
Nuclear Dual Purpose Plants in Regional Development,			
W73-11496	3A		
JUNG, G.			
X-Ray Photoelectron Spectroscopy of Metals in Amino Acid Complexes and Proteins, (Rontgen-Photoelektronenspektroskopie von Metallen in Aminosäurekomplexen und Proteinen),			
W73-11121	5A		
KABAI, I.			
Behaviour of Transition Soils Under the Effect of Water,			
W73-11198	2G		
KAMENOV, B.			
Relationships Between Volume and Pore-Water Change and Shear Stress in Granular Soils,			
W73-11197	2G		
KAMINSKY, E. L.			
Marine Sanitation System Demonstration,			
W73-11059	5D		

AUTHOR INDEX

KAMPELMACHER, E. H.

KAMPELMACHER, E. H.
Occurrence of *Salmonella* in Oxidation
Ditches,
W73-11136

5A

KAMRANY, N. M.
Economic Growth and Environmental Impact:
Evaluating Alternatives,
W73-11511

6B

KANG, S. W.
Cation Exchange Separation of Metal Ions
With Potassium Chloride-Chelating Agent-Organic
Solvent Medium,
W73-11311

5A

KARLOV, V. D.
Moisture Transfer and Frost Heave in Loams,
W73-11193

2G

KARLSSON, I.
Torsional Stiffness of Reinforced Concrete
Members Subjected to Pure Torsion,
W73-11519

8F

KATZ, B.
Removal of Oil From Under Piers,
W73-11438

5G

Use of Fire Streams to Control Floating Oil,
W73-11435

5G

KATZER, T. L.
Bathymetric Reconnaissance of Weber Reservoir,
Mineral County, Nevada,
W73-11220

7C

Bathymetric Reconnaissance of Wild Horse
Reservoir, Elko County, Nevada,
W73-11219

7C

KAUFMAN, W. J.
Accelerated Biological-Chemical Wastewater
Treatment,
W73-11229

5D

KEENEY, D. R.
Mercury Accumulation by *Myriophyllum
Spicatum* L.,
W73-11168

5C

KELLER, B. M.
Great Glaciations in the History of the Earth
(*Velykiye oledeneniya v istorii Zemli*),
W73-11095

2C

KELLOGG, W. W.
Climate Change and the Influence of Man's Activities
on the Global Environment,
W73-11562

2A

KEMP, N. R.
Recent Developments in the Analytical Application
of UV Photoelectron Spectroscopy,
W73-11489

5A

KENNER, B. A.
Land Spreading, A Conserving and Non-Polluting
Method of Disposing of Oily Wastes,
W73-11535

5E

KERIN, Z.
Environmental Contamination by Lead from a
Mine and Smelter,
W73-11267

5C

KERMODE, R. I.
Generic Feed Forward Control of Activated
Sludge,
W73-11362

5D

KESHAVAN, K.

Combined Effect of Thermal and Organic Pollution
on Oxygen Sag Curve,
W73-11423

5C

KESNER, W. D.

Ecological and Physiological Implications of
Greenbelt Irrigation - Phase I,
W73-11424

5D

KETCHUM, B. H.

Smithsonian Advisory Committee Report on
Studies of the Effects of Waste Disposal in the
New York Bight,
W73-11642

5C

KEZZI, A.

Behaviour of Transition Soils Under the Effect
of Water,
W73-11198

2G

KHANNA, P.

Enumeration and Differentiation of Water Bacteria
with Phosphorus-32,
W73-11133

5A

KHOREV, V. S.

Rate of Retreat of Yuzhno-Chuya Glaciers in the
Gorno-Alтай Autonomous Oblast (O
skorost' otstupaniy lednikov Yuzhno-
Chuyskikh belkov Gornogo Altaya),
W73-11097

2C

KIDD, J. P.

How to Cut Drilling Costs by Reducing Non-
drilling Time,
W73-11460

8A

KILHSTROM, J. E.

Low pH Values Shown to Affect Developing
Fish Eggs (*Brachydanio reric Ham.-Buch.*),
W73-11651

5C

KIM, A. G.

Groundwater Regime in the Zone of Influence
of Pumping (Rezhim gruntovyykh vod v zone
vlyaniya vertikal'nogo drenazha),
W73-11094

4B

KIMMEL, W. G.

Fish and Food Organisms in Acid Mine Waters
of Pennsylvania,
W73-11332

5C

KINSEY, D. W.

Small-Scale Experiments to Determine the Ef-
fects of Crude Oil Films on Gas Exchange
Over the Coral Back-Reef at Heron Island,
W73-11650

5C

KIRBY, R.

The U.C.S. Grain-Size Comparator Disc,
W73-11395

7B

KIRDA, C.

Simultaneous Transport of Chloride and Water
During Infiltration,
W73-11213

2K

KJERFVE, B.

Volume Transport, Salinity Distribution and
Net Circulation in the Duplin Estuary, Georgia,
W73-11425

2L

KLATZ, L. N.

Anodic Stripping Voltammetry at a Tubular
Mercury-Covered Graphite Electrode,
W73-11484

5A

KLEIN, D. H.

Heavy Metals: Fallout Around a Power Plant,
W73-11282

5A

KLEPPER, B.

Radial Propagation of Water Potential in
Stems,
W73-11181

3F

KLUESNER, J. W.

Organic Loading of Petenwell Reservoir,
Wisconsin,
W73-11486

5C

KNIGHT, K. L.

The Effects of Ditching on the Mosquito Popula-
tions in Some Sections of *Juncus* Salt Marsh
in Carteret County, North Carolina,
W73-11431

4A

KOBAYASHI, M.

Construction of a Purification Plant for Pol-
luted Water Using Photosynthetic Bacteria,
W73-11569

5D

KOCH, W.

Anion Exchange Separations of the Elements
Extractable with Tributyl Phosphate. IV.
(Anionenaustausch trennungen der Mit Tribu-
tylphosphat extrahierbaren Elemente. IV),
W73-11122

5A

KOCHELABA, YE. I.

Precomputation of a Spring-Flood Hydrograph
Based on Hydrometeorological Data
(Predvychisleniye gidrografs vesennego
polovod'ya po gidrometeorologicheskim dan-
nym),
W73-11689

2E

KOIKE, H.

Coefficient of Permeability of Highly Plastic
Clays,
W73-11199

2G

KOLIPINSKI, M. C.

Applications of Multispectral Remote Sensing
Techniques to Hydrobiological Investigations
In Everglades National Park,
W73-11553

7B

KONDO, K.

Epidemiological Study on *Clondorchis sinensis*
Around Lake Biwa, Shiga Prefecture: I. Survey
on Distribution of *Parafossarulus Manchou-
ricus*, The First Intermediate Host Snail (In
Japanese),
W73-11654

2H

KOOB, D. D.

The Relationship of Enzyme Kinetic
Heterotrophy Analysis to Other Eutrophication
Indices,
W73-11432

5C

KOONCE, B.

The Biggest Artesian Well in the World,
W73-11481

8A

KOP, M.

Environmental Contamination by Lead from a
Mine and Smelter,
W73-11267

5C

KORCZAK, B.

Alpha-Al203 as an Adsorbent in Thin-Layer
Chromatography,
W73-11128

5A

KORIMOV, S.

Inflow to Rivers in the Pamirs (Pitaniye rek
Pamira),
W73-11096

2C

AUTHOR INDEX

LEONET, O.

KORKISCH, J.		KRUMHOLZ, L. A.		LEACH, J. M.
Anion Exchange Separations of the Elements Extractable with Tributyl Phosphate. IV, (Anionenaustausch trennungen der Mit Tributylphosphat Extrahierbaren Elemente. IV), W73-11122	5A	The Freshwater Stream, A Complex Ecosystem, W73-11389	6G	Identification of the Constituents of Kraft Pulping Effluent That are Toxic to Juvenile Coho Salmon (<i>Oncorhynchus kisutch</i>), W73-11638
KOROTCHENKO, O. D.		KRUTIKOVA, A. I.		LEACHTENAUER, J.
Arsenic in the Lipid Extracts of Marine Invertebrates, W73-11189	5C	Distribution and Composition of Mineral Water in the Tuva Autonomous Republic (Zakonomernosti rasprostraneniya i sostav podzemnykh mineral'nykh vod Tuvy), W73-11412	2F	Natural Resource Information System Remote Sensing Studies, W73-11371
KOSHELEVA, L. P.		KUBO, J.		LEBORNE, R. P.
Arsenic in the Lipid Extracts of Marine Invertebrates, W73-11189	5C	A New Method for the Soil Moisture Measurement (Momin's Method), W73-11117	2G	Study of the Respiration and the Nitrogen and Phosphorus Excretion of Zooplanktonic Populations of the Mauritanian Upwelling, (March-April 1972). (Etude de la Respiration et de l'Excretion d'Azote et de Phosphore des Populations Zooplanctoniques de l'Upwelling Mauritanien (Mars-Avril 1972)), W73-11603
KOVERNYY, L. A.		KUENEN, J. G.		LEE, D. W.
Characteristics of Ice-Jam Formation on the Soviet Reach of The Danube (Osobennosti zatoroobrazovaniya na sovetskem uchastke Dunay), W73-11694	2C	Low Cost Multichannel Scanning pH-Stat, W73-11492	5A	Cation Exchange Separation of Metal Ions With Potassium Chloride-Chelating Agent-Organic Solvent Medium, W73-11311
KRATOCHVIL, B.		KUSTOV, YU. I.		LEE, G. F.
Determination of Phenols and Aromatic Amines by Direct Titration with Bromine in Propylene Carbonate, W73-11485	5A	Distribution and Composition of Mineral Water in the Tuva Autonomous Republic (Zakonomernosti rasprostraneniya i sostav podzemnykh mineral'nykh vod Tuvy), W73-11412	2F	Organic Loading of Petenwell Reservoir, Wisconsin, W73-11486
KRAUSE, D. C.		LABARRE, N.		LEE, J. A.
Sediments in the Atlantic Corner Seamounts: Control by Topography, Paleo-Winds, and Geochemically-Detected Modern Bottom Currents, W73-11394	2J	Lead Contamination of Snow, W73-11275	5B	Lead Pollution from a Factory Manufacturing Anti-Knock Compounds, W73-11290
KRAUSE, R. D.		LACONI, A. B.		LEE, K. S.
Determination of Phenols and Aromatic Amines by Direct Titration with Bromine in Propylene Carbonate, W73-11485	5A	Research on Reverse Osmosis Membranes for Purification of Wash Water at Sterilization Temperature (165°F), W73-11159	3A	Cation Exchange Separation of Metal Ions With Potassium Chloride-Chelating Agent-Organic Solvent Medium, W73-11311
KRISHNAMOORTHY, C. S.		LAKSHMAN, B. T.		LEE, L. A.
Simplified Computer Approach to the Ultimate Load Analysis and Design of Reinforced Concrete Frames, W73-11499	8F	Hydraulic Model Measurements of Tidal Currents Around Cape Henlopen, Delaware, W73-11203	2L	Investigation of Polybenzimidazole Hollow Fiber Reverse Osmosis Desalination Membranes, W73-11157
KRISHNAN, A.		LAL, D.		LEE, R. K.
Analysis of Soil Temperatures in the Arid Zone of India by Fourier Techniques, W73-11177	2G	Manganese Nodules and Budget of Trace Solubles in Oceans, W73-11384	5B	All-Position Production Welding with Flux-Cored Gas-Shielded Electrodes, W73-11501
KRISHNAN, K. P. R.		LAM, C. F.		LEGAL, C. C. JR
Supplementation of Missing Values in Water Quality Data, W73-11687	5G	Discrete Gradient Optimization of Water Systems, W73-11365	8B	Purification of Waste Water, W73-11238
KRISHNASWAMI, S.		LAMBERT, I. B.		LEHNERT, J.
Accretion Rates of Freshwater Manganese Deposits, W73-11088	2J	Volcanic Exhalations and Metal Enrichments at Matupi Harbor, New Britain, T.P.N.G., W73-11292	5B	Bituminous Blanket for Dike at Ludington Pumped Storage Project, W73-11504
KRISHNASWAMY, S.		LARIMER, O. J.		LEITZ, F. B.
Manganese Nodules and Budget of Trace Solubles in Oceans, W73-11384	5B	Flood of June 9-10, 1972, at Rapid City, South Dakota, W73-11105	7C	Research on Piezodialysis, Third Report, W73-11154
KRIVAK, J. A.		LAROCHE, G.		LELIEVRE, H.
Wastewater Management Through Land Utilization - Muskegan County, Michigan, USA, W73-11515	5D	Copper Induced Lesions in Estuarine Teleosts, W73-11616	5C	Sea Fish Contamination With Mercury (Contamination des poissons de mer par le mercure), W73-11289
KROGER, R. L.		LASALLE, R. N.		LEONARD, E. N.
Biological Effects of Fluctuating Water Levels in the Snake River, Grand Teton National Park, Wyoming, W73-11594	2E	The Effects of Ditching on the Mosquito Populations in Some Sections of Juncus Salt Marsh in Carteret County, North Carolina, W73-11431	4A	Acute and Long-Term Accumulation of Copper by the Brown Bullhead, <i>Ictalurus nebulosus</i> , W73-11593
		LAUGHLIN, C. P.		LEONET, O.
		Hydrologic Records for Volusia County, Florida: 1971-72, W73-11399	7C	Study of the Behavior of a Roof with Various Bolting Systems, W73-11503

AUTHOR INDEX

LEPLEY, L. K.

LEPLEY, L. K.
Direct Determination of the Electromagnetic Reflection Properties of Smooth Brackish Water to the Continuous Spectrum from 100 million to 4 billion Hertz,
W73-11052 2L

LEUNG, P. S.
A Neutron Spectroscopic Study of the Diffusive Kinetics and Interactions of Water in Dense Layer Desalination Membranes,
W73-11165 3A

LEVIN, V. S.
Arsenic in the Lipid Extracts of Marine Invertebrates,
W73-11189 5C

LEVY, E. M.
Dispersed and Particulate Petroleum Residues in the Gulf of St. Lawrence,
W73-11612 5B

LEWIS, E.
Volatilization of Mercuric Chloride by Mercury-Resistant Plasmid-Bearing Strains of *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*,
W73-11286 5B

LI, W. C.
Measurement of Exchangeable Inorganic Phosphate in Lake Sediments,
W73-11596 5A

LIEN, S. L.
Circulation Patterns in Lake Superior,
W73-11342 2H

LIESER, K. H.
Application of Radiochemical Methods in Environmental Research, (Anwendung Radiochemischer Methoden in der Umweltforschung),
W73-11125 5A

LILLY, V. G.
Ferrous Iron and the Growth of Twenty Isolates of Phytophthora Infestans in Synthetic Media,
W73-11490 5A

LIN, P. M.
Characteristics and Environmental Quality of Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York,
W73-11108 2K

Survey of Water Quality and Sediments in Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York (Appendix to Technical Report No. 14),
W73-11109 2K

LIN, T. S.
Dispersion and Miscible Displacement,
W73-11167 3A

LINES, J. M.
BOD: Determining the Necessary Dilution Technique,
W73-11661 5A

LITTLE, C. G.
Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering,
W73-11631 5A

LITTLE, R. L.
Operation of the Analytical Methodology Information Center,
W73-11336 5A

LIU, C.
River Systems Transition Function and Operation Study,
W73-11364 4A

LIU, D.
Determination of Carbohydrate in Lake Sediment by a Modified Phenol-Sulfuric Acid Method,
W73-11482 5A

LIU, D. L.
Biological Oxidation of the Hydrocarbons in Aqueous Phase,
W73-11132 5B

LO, C. T.
Studies on Schistosomiasis in Mekong Basin: II. Malacological Investigations on Human Schistosoma from Laos,
W73-11633 5C

LOBMEYER, D. H.
Ground Water in Finney County, Southwestern Kansas,
W73-11106 7C

LOEFFLER, W.
Characteristics and Environmental Quality of Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York,
W73-11108 2K

Survey of Water Quality and Sediments in Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York (Appendix to Technical Report No. 14),
W73-11109 2K

LOGAN, T. J.
Effect of Soil, Cover, Slope, and Rainfall Factors on Soil and Phosphorus Movement Under Simulated Rainfall Conditions,
W73-11208 5B

LONG, W. A.
Ground Water in Finney County, Southwestern Kansas,
W73-11106 7C

LOPEZ, M.
Nuclear Dual Purpose Plants in Regional Development,
W73-11496 3A

LOVERIDGE, E. L.
Pesticides in Water,
W73-11618 5B

LUDWIG, A. H.
Water Resources of Hempstead, Lafayette, Little River, Miller, and Nevada Counties, Arkansas,
W73-11222 4B

LUE-HING, C.
Chemical and Biological Quality of Municipal Sludge,
W73-11679 5E

L'VOV, S. A.
Problem of the Influence of Shape of Channel Cross Section on Velocity Distribution in a Uniform Turbulent Flow (K vopros o vliyanii formy secheniya rulsa na raspredeleniye skorostey v ravnomernom turbulentnom potokе),
W73-11408 8B

LVALIN, G. N.
The Influence of Simazine on the Photosynthetic Pigments of Green Algae,
W73-11610 5C

LYNN, L. G.
Waste Water Sampler,
W73-11243 5A

LYSYJ, I.
Pyrographic Gross Characterization of Water Contaminants,
W73-11446 5A

MACEK, K. J.
Survival and Gill Condition of Bluegill (*Lepomis macrochirus*) and Fathead Minnows (*Pimephales promelas*) Exposed to Sodium Nitrilotriacetate (NTA) for 28 Days,
W73-11621 5C

MACHTA, L.
The Role of the Oceans and Biosphere in the Carbon Dioxide Cycle,
W73-11373 2K

MACK, W. N.
Investigations into the Occurrence of Coliform Organisms from Pristine Streams,
W73-11428 5B

MACKENZIE, R. C.
Sludge Concentration,
W73-11357 5D

MACLEOD, J. C.
Temperature Effects on Mercury Accumulation, Toxicity, and Metabolic Rate in Rainbow Trout (*Salmo gairdneri*),
W73-11655 5C

MAGOS, L.
Transfer of Metallic Mercury into the Foetus,
W73-11274 5B

MALCOLM, D. C.
Soil Physical Factors Affecting Root Morphology and Stability of Scots Pine on Upland Heaths,
W73-11173 4A

MANAHAN, S. E.
Copper Determination in Water by Standard Addition Potentiometry,
W73-11605 5A

MANDICS, P. A.
Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering,
W73-11631 5A

MANGELSDORF, P. C. JR
Analysis of Sea Water by Difference Chromatography. Summary of Progress 1972,
W73-11584 5A

MANGES, H. L.
Ground Water Recharge Through Pits and Wells,
W73-11053 4B

MANJREKAR, T. G.
Removal of Oil From Water Surfaces By Sorption on Unstructured Fibers,
W73-11586 5G

MANKU, G. S.
2,3-Dihydroxynaphthalene as Indicator for the Complexometric Titration of Iron (III) with EDTA,
W73-11641 5A

MANSELL, R. S.
Movement of Acarol and Terbicil Pesticides During Displacement Through Columns of Wahasso Fine Sand,
W73-11537 5B

AUTHOR INDEX

MERCER, W. A.

MANSUE, L. J. Effects of Land Use and Retention Practices on Sediment Yields in the Stony Brook Basin, New Jersey, W73-11113	4C		
MARCY, V. M. Atomic Absorption Spectrophotometry as a Tool for the Water Chemist, W73-11294	5A		
MARCZAL, L. Behaviour of Transition Soils Under the Effect of Water, W73-11198	2G		
MARGANIAN, V. M. Dursban (Trademark) and Diazinon Residues in Biota Following Treatment of Intertidal Plots on Cape Cod - 1967-69, W73-11627	5C		
MARGULIS, R. I. Use of Digital Computers to Compute Propagation of Flood Waves Along the Cascade of Reservoirs on the Dnieper River (Primeneniye ETsVM diya rascheta rasprostraneniya voln polovodiy po kaskadu gidrouzov na Dnepre), W73-11693	2E		
MARRANCI, G. Acquisition and Reduction of Gas Chromato- graphic Data Using a Computer, W73-11491	5A		
MARSHALL, M. D. Control of Hazardous Chemical Spills by Physical Barriers, W73-11338	5G		
MARTIN, D. M. The Role of Nitrogen in the Aquatic Environ- ment, W73-11640	5C		
MARVIN, C. W. Determining the Strength of Corroded Pipe, W73-11527	8G		
MASON, W. D. Anodic Stripping Voltammetry at a Tubular Mercury-Covered Graphite Electrode, W73-11484	5A		
MASSEY, J. R. Control of Insulator Contamination in Substa- tions, W73-11506	8C		
MATHEW, E. Organic Materials in the Marine Environment and the Associated Metallic Elements, W73-11184	5B		
MATSUI, E. S. Procedure Improved for Determining Corrosion Rate by Weight Loss, W73-11478	8G		
MATSUMURA, F. Pesticide Degradation by Marine Algae, W73-11601	5B		
Phenylmercuric Acetate: Metabolic Conversion by Microorganisms, W73-11187	5B		
MATSUO, K. Epidemiological Study on Clondorchis sinensis Around Lake Biwa, Shiga Prefecture: I. Survey on Distribution of Parafossarulus Manchou-			
		ricus, The First Intermediate Host Snail (In Japanese), W73-11654	2H
		MATTHEWS, D. R. Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection, W73-11606	5A
		MATTHEWS, W. R. Typical Log-Curve Shapes Indicate Formation Characteristics, W73-11456	8A
		MATZ, R. The Mechanism of Formation of 'Skinned' Type Membranes and Their Characterization, W73-11153	3A
		MAWDSELEY, J. A. Computing Evapotranspiration by Geostrophic Drag Concept, W73-11345	2D
		MAY, B. E. Effects of Chemical Variations in Aquatic En- vironments: Volume I. Biota and Chemistry of Pierce Creek, W73-11074	5C
		MAYHUE, L. F. Solvent Extraction Status Report, W73-11066	5D
		MAZZAFERRIO, D. L. Water Resources Inventory of Connecticut: Part 6. Upper Housatonic River Basin, W73-11555	2A
		MCCARTHY, J. L. Steam Stripping Odorous Substances from Kraft Effluent Streams (SEKOR), W73-11060	5D
		MCCARTHY, L. T. JR Standard Dispersant Effectiveness and Toxicity Tests, W73-11442	5A
		MCDONALD, C. W. Liquid-Liquid Extraction of Cadmium With High-Molecular-Weight Amines From Iodide Solutions, W73-11664	5A
		MCDOWELL, C. S. Activated Sludge Sewage Treatment Process and System, W73-11239	5D
		MCGARR, A. Seismic Seiches in Bays, Channels, and Estua- ries, W73-11532	2H
		MCGOVERN, H. E. Ground Water in Finney County, Southwestern Kansas, W73-11106	7C
		MCGREGOR, B. A. Sediments in the Atlantic Corner Seamounts: Control by Topography, Paleo-Winds, and Geochemically-Detected Modern Bottom Cur- rents, W73-11394	2J
		MCHUGH, J. H. Smithsonian Advisory Committee Report on Studies of the Effects of Waste Disposal in the New York Bight, W73-11642	5C
		MCINTYRE, D. R. Metabolism of Tritiated Water in the Dairy Cow, W73-11186	5B
		MCKIM, J. M. Acute and Long-Term Accumulation of Copper by the Brown Bullhead, <i>Ictalurus Nebulosus</i> , W73-11593	5C
		MCKINNEY, R. E. Activated Sludge Process and System, W73-11240	5D
		MCLEAN, D. C. Evaluation of Pollution Abatement Procedures Moraine State Park, W73-11062	5G
		MCLEAN, E. O. Effect of Soil, Cover, Slope, and Rainfall Fac- tors on Soil and Phosphorus Movement Under Simulated Rainfall Conditions, W73-11208	5B
		MCLEAY, D. J. Effects of a 12-Hr and 25-Day Exposure to Kraft Pulp Mill Effluent on the Blood and Tis- sues of Juvenile Coho Salmon (<i>Oncorhynchus</i> <i>kisutch</i>), W73-11620	5C
		MCLEEESE, D. W. Response of Lobsters <i>Homarus americanus</i> to Odor Solution in The Presence of Bleached Kraft Mill Effluent, W73-11619	5C
		MCMINN, T. J. Crude Oil Behavior on Arctic Winter Ice, W73-11539	5B
		MEEHAN, R. L. Ground Rupture in the Baldwin Hills, W73-11206	5E
		MEEHAN, W. R. A Solvent Extraction Method for the Deter- mination of Phosphorus-32 in Sea Water, W73-11643	5A
		MELTZ, S. J. Geonatural Resource Planning, Proposed Guidelines for a Detailed Geonatural Resource Inventory and Analysis Required to Undertake a Comprehensive Planning and Development for Albany/Dougherty County, Georgia, W73-11672	7A
		MELVIN, R. L. Water Resources Inventory of Connecticut: Part 6. Upper Housatonic River Basin, W73-11555	2A
		MENARD, P. B. Some Aspects of the Geochemistry of Marine Aerosols, W73-11372	2K
		MERCER, W. A. Low Water Volume Enzyme Deactivation of Vegetables Before Preservation, W73-11330	5D

AUTHOR INDEX

MERRITT, G. L.

- MERRITT, G. L.
The Need for Hydrogeologic Evaluations in a Mine Drainage Abatement Program: A Case Study, Toms Run, Clarion County, Pennsylvania, W73-11674 5G
- MERRITT, R. C.
Environment, W73-11183 5C
- MEYER, A. S.
Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection, W73-11606 5A
- MICHEL, J. L.
Nitrogen and Phosphorus Uptake by Chlorella pyrenoidosa in Sewage Treatment Processes, W73-11617 5B
- MICHEL, T. M.
Nitrogen and Phosphorus Uptake by Chlorella pyrenoidosa in Sewage Treatment Processes, W73-11617 5B
- MIDDLEBROOKS, E. J.
Taste and Odor Control in Water, W73-11318 5F
- MIDDLEITCH, B. S.
Comparison of Selective Ion Monitoring and Repetitive Scanning During Gas Chromatography-Mass Spectrometry, W73-11493 5A
- MIDGETT, M. R.
Determination of Total Chromium in Fresh Waters by Atomic Absorption, W73-11295 5A
- MIDGLEY, D. C.
A Mathematical Model to Aid Management of Outflow from the Okavango Swamp, Botswana, W73-11543 6A
- MILES, D. L.
Water Infiltration Under Center-Pivot Sprinklers, W73-11514 8B
- MILLAR, R. M.
Preliminary Report, (RV Thomas G. Thompson Cruise 66), W73-11583 5A
- MILLER, E.
Development and Preliminary Design of a Sorbent-Oil Recovery System, W73-11071 5G
- MILLER, E. M.
Virginia Small Streams Program, Preliminary Flood-Frequency Relations, W73-11090 2E
- MILLER, G. C.
Parasite Copepods of Some Freshwater Fishes from North Carolina, W73-11143 2I
- MILLER, M. M.
A Principal Study of Factors Affecting the Hydrological Balance of the Lemon Glacier System and Adjacent Sectors of the Juneau Icefield, Southeastern Alaska, 1965-1969, W73-11054 2C
- MILLHAM, C. B.
On Large Diversions from the Northwest-Normal and High-Flow Years, W73-11685 6A
- MILNE, J. B.
Lead Contamination of Snow, W73-11275 5B
- MITCHELL, J. W.
Ultraviolet in Trace Analysis, W73-11483 5A
- MITCHELL, R.
Ecology of Yellowstone Thermal Effluent Systems: Intersects of Blue-Green Algae, Grazing Flies (Paracoenia, Ephydriidae) and Water Mites (Partuniciida, Hydrachnidae), W73-11131 5C
- MITCHENER, M.
Toxic Effects of Trace Elements on the Reproduction of Mice and Rats, W73-11190 5C
- MODEL, F. S.
Investigation of Polybenzimidazole Hollow Fiber Reverse Osmosis Desalination Membranes, W73-11157 3A
- MODICA, A.
Spray Freezing, Decanting, Melting and Hydrolysis as Related to Secondary Refrigerant Desalting, W73-11158 3A
- MOLZ, F. J.
Radial Propagation of Water Potential in Stems, W73-11181 3F
- MOORE, C. V.
Programing Model for Evaluating Economic and Financial Feasibility of Irrigation Projects with Extended Development Periods, W73-11149 3F
- MOORE, F. L.
Liquid-Liquid Extraction of Cadmium With High-Molecular-Weight Amines From Iodide Solutions, W73-11664 5A
- MOORE, J. T.
A Case History of Santa Cruz Harbor, California, W73-11092 8B
- MOORE, R. V.
Neutron Activation Analysis of Bottom Sediments, W73-11067 5A
- MOORE, W. S.
Accretion Rates of Freshwater Manganese Deposits, W73-11088 2J
- MORELLI, J.
Some Aspects of the Geochemistry of Marine Aerosols, W73-11372 2K
- MORGAN, R. P. II
Sublethal Effects of Baltimore Harbor Water on the White Perch, Morone americana, and the Hogchoker, Trinectes maculatus, W73-11652 5C
- MORIN, G. C. A.
Steady-State Seepage in a Hillside, W73-11212 2G
- MORSE, M. L.
Continuous Culture of Rhodotorula rubra: Kinetics of Phosphate-Arsenate Uptake, Inhibition, and Phosphate-Limited Growth, W73-11574 5A
- MOSS, B.
Plant Communities of Wet Ground in Northeast Cheshire, England, W73-11552 2L
- MUELLER-HAECKEL, A.
Experiments on the Movement Behavior of Single-Cell Flowing Water Algae, (Experimente Zum Bewegungsverhalten Von Einzelligen Fleisswasseralgien), W73-11626 5C
- MUIR, J.
Influence of Agricultural Practices on Water Quality in Nebraska: A Survey of Streams, Groundwater, and Precipitation, W73-11696 5B
- MUN, A. I.
Distribution of Trace Elements in Bodies of Water of Kazakhstan (Raspredeleniye mikroelementov v vodoyemakh Kazakhstana), W73-11413 2K
- MUNN, D. A.
Effect of Soil, Cover, Slope, and Rainfall Factor on Soil and Phosphorus Movement Under Simulated Rainfall Conditions, W73-11208 5B
- MURPHY, R.
Softening A 46-Grain Water, W73-11665 5F
- MURRAY, J. W.
Living Foraminiferids of Tidal Marshes: A Review, W73-11502 2L
- MUSOYAN, S. G.
Distribution of Average Turbidity of Rivers in the Armenian SSR (Raspredeleniye sredney mutnosti rek po territorii Armysanskoy SSR), W73-11099 2E
- MUSPRATT, M. A.
Numerical Statistics in Engineering Geology, W73-11517 8G
- NAGAHANA, M.
Epidemiological Study on Clondorchis sinensis Around Lake Biwa, Shiga Prefecture: I. Survey on Distribution of Parafossarulus manchouricus, The First Intermediate Host Snail (In Japanese), W73-11654 2H
- NAKAGAWA, S.
Coefficient of Permeability of Highly Plastic Clays, W73-11199 2G
- NAKAHARA, R. H.
An Investigation of Floods in Hawaii Through September 30, 1972, W73-11404 2E
- NAKANISHI, H.
Construction of a Purification Plant for Polluted Water Using Photosynthetic Bacteria, W73-11569 5D

AUTHOR INDEX

PENTREATH, R. J.

NAMIAS, J. Large-Scale and Long-Term Fluctuations in some Atmospheric and Oceanic Variables, W73-11369	2B	NIMLOS, T. The Response of Native Montana Grasses to Soil Water Stress, W73-11429	2I	OTT, A. N. An Inventory of Suspended Sediment Stations and Type of Data Analysis for Pennsylvania Streams, 1947-70, W73-11083	2J
NANNI, U. W. The Effect of Afforestation on Streamflow at Cathedral Peak: Report No. 1, W73-11310	4C	NISHI, T. Studies on the Sources of Pollution in Dairy Water: I. Properties of the Waste Water From Potato Starch Factories (In Japanese), W73-11284	5B	OTTNAD, M. X-Ray Photoelectron Spectroscopy of Metals in Amino Acid Complexes and Proteins, (Rontgen-Photoelektron-Spektroskopie von Metallen in Aminosäurekomplexen und Proteinen), W73-11121	5A
NAPHAN, E. A. Freeze-Free (32 F) Seasons of the Major Basins and Plateaus of Nevada, W73-11218	7C	NISHIDA, Y. Coefficient of Permeability of Highly Plastic Clays, W73-11199	2G	OWENS, T. Preliminary Report, (RV Thomas G. Thompson Cruise 66), W73-11583	5A
NEBOLSINE, R. Ultra High Rate Filtration of Activated Sludge Plant Effluent, W73-11337	5D	NIYOGI, S. A Colorimetric Technique Suggested for Chemical Oxygen Demand Determination, W73-11599	5A	PAIN, W. R. Abnormal Pressures in Deep Wells of Southwestern Louisiana, W73-11464	8E
NEELY, H. M. Vacuum Skimming Apparatus for Removing Liquid Contaminants Floating in Confined Bodies of Water, W73-11232	5G	NORTON, V. J. Smithsonian Advisory Committee Report on Studies of the Effects of Waste Disposal in the New York Bight, W73-11642	5C	PAL, DHAN Measurement of Contact Angle of Water in Soils and Sand, W73-11273	2G
NEFF, S. B. The Freshwater Stream, A Complex Ecosystem, W73-11389	6G	NOVAK, L. Environmental Contamination by Lead from a Mine and Smelter, W73-11267	5C	PALENSKY, J. R. Impairment of the Flavor of Fish by Water Pollutants, W73-11322	5C
NELSON, J. L. Radionuclides in Transport in the Columbia River from Pasco to Vancouver, Washington, W73-11549	5B	NOVOTNY, C. J. Curtailing Pollution from Metal Finishing, W73-11283	5D	PALMER, C. M. Evaluation of New Algicides for Water Supply Purposes, W73-11353	5F
NELSON, N. H. H2S Removal from Water Without Air Pollution, W73-11314	5F	NUNGE, R. J. Dispersion and Miscible Displacement, W73-11167	3A	PAREMENSKAYA, L. N. The Influence of Simazine on the Photosynthetic Pigments of Green Algae, W73-11610	5C
NETSCHERT, B. C. Energy vs. Environment, W73-11500	6G	ODUM, H. T. Chemical Cycles with Energy Circuit Models, W73-11381	2A	PARUNIN, O. B. Rate of Retreat of Yuzhno-Chuya Glaciers in the Gorno-Altay Autonomous Oblast (O skorosti ostupanii lednikov Yuzhno-Chuiskikh belkov Gornogo Altaya), W73-11097	2C
NEVEL, D. E. Ice Forces on Vertical Piles, W73-11538	8B	OLIVER, B. G. Lead Contamination of Snow, W73-11275	5B	PASSINO, R. Apparatus for Use in an Improved Electro-Dialysis Process, W73-11230	3A
NEWCOMB, R. C. Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington, W73-11204	5B	OLIVER, D. R. Seasonal Emergence of Some High Arctic Chironomidae (Diptera), W73-11148	2I	PATTERSON, R. L. Water Quality Models for Total Coliform, W73-11135	5B
NEWTON, P. R. Pyrographic Gross Characterization of Water Contaminants, W73-11446	5A	OLSON, C. E. Financing Private Water Resource Development: Analysis of a State Loan Program, W73-11686	3F	PAUL, J. BOD: Determining the Necessary Dilution Technique, W73-11661	5A
NICHOLLS, J. W. P. The Effect of Environmental Factors on Wood Characteristics: I. The Influence of Irrigation on Pinus Radiata from South Australia, W73-11452	4A	OLSON, R. A. Influence of Agricultural Practices on Water Quality in Nebraska: A Survey of Streams, Groundwater, and Precipitation, W73-11696	5B	PAULSON, R. A. Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material, W73-11339	5A
NIELSEN, D. R. Simultaneous Transport of Chloride and Water During Infiltration, W73-11213	2K	ONUSKA, F. I. Gas Chromatographic and Mass Spectrometric Studies of S-Alkyl Derivatives of N,N-Dialkyl Dithiocarbamates, W73-11622	5A	PEIRSON, D. H. Trace Elements in the Atmospheric Environment, W73-11299	5A
NIKOL'SKAYA, N. V. Information on Activities of the Commission on Surface Waters of the International Association of Scientific Hydrology (IASH) (Informatsiya o rabote komissii poverkhnostnykh vod Mezhdunarodnoy assotsiatii nauchnoy hidrologii (MANG)), W73-11414	2A	OPHUS, E. Lead Accumulation Within Nuclei of Moss Leaf Cells, W73-11276	5E	PENTREATH, R. J. The Accumulation from Water of ZN-65, MN-54, CO-58, and FE-59 by the Mussel, <i>Mytilus edulis</i> , W73-11625	5A

AUTHOR INDEX

PENZIAS, G. J.

PENZIAS, G. J.
Gas Chromatograph Peaks Identified On-Line
by a New Grating Infrared Spectrophotometer,
W73-11609 5A

PERHAM, R. E.
Ice Forces on Vertical Piles,
W73-11538 8B

PESSAH, E.
Temperature Effects on Mercury Accumulation, Toxicity, and Metabolic Rate in Rainbow Trout (*Salmo gairdneri*),
W73-11655 5C

PETERING, H. G.
Trace Metal Content of Hair, I. Zinc and copper Content of Human Hair in Relation to Age and Sex,
W73-11308 5A

PETERS, G. L.
Reduction of Hydraulic Sewer Loadings by Downspout Removal,
W73-11671 4A

PETERSEN, R. C.
Leaf Processing in a Woodland Trout Stream,
W73-11112 5B

PETERSON, F. F.
Freeze-Free (32 F) Seasons of the Major Basins and Plateaus of Nevada,
W73-11218 7C

PETERSON, J. L.
Pesticides in Water,
W73-11618 5B

PETERSON, J. R.
Chemical and Biological Quality of Municipal Sludge,
W73-11679 5E

PETERSON, S. F.
Multi-Element Neutron Activation Analysis of Sediment Using a Californium-252 Source,
W73-11644 5A

PETRO, J.
Process for the Removal of Cyanide from Sewage by Means of Formaldehyde,
W73-11224 5D

PEZZETTA, J. M.
Falling-Drop Technique for Silt-Clay Sediment Analysis,
W73-11558 5A

PFEIFFER, G. H.
Financing Private Water Resource Development: Analysis of a State Loan Program,
W73-11686 3F

PFITZNER, E.
Prague International Lead Panel: Effects of Atmospheric Lead on Biological Systems,
W73-11265 5C

PFLUGMACHER, J.
Clean-Up of Crude Extracts Containing Pesticide Residues by an Automatic Apparatus Based Upon the Principle of 'Sweep Co-Distillation' (Reinigung Pesticiddruckstange Enthalender Rohextrakte Mit Einer Automatisch Arbeitenden Apparatur Nach Dem Prinzip der

Kombinierten Spülund Codestillation (Sweep Codistillation),
W73-11124 5A

PHILIPP, W. H.
Survey of Application of Radiation to Preparative Chemistry,
W73-11119 2K

PHINNEY, H. K.
Effects of Logging on Periphyton in Coastal Streams of Oregon,
W73-11582 5C

PIERRARD, J. M.
Auto Exhaust - Lead Vs Aromatics,
W73-11301 5A

PIEST, R. F.
Phosphorus Losses From Four Agricultural Watersheds on Missouri Valley Loess,
W73-11209 5B

PILIPCHUK, M. F.
Some Problems in the Geochemistry of Molybdenum in the Mediterranean Sea (Nekotorye voprosy geokhimii molibdena v Sredizemnom more),
W73-11410 2K

PILLAI, T.N.V.
Organic Materials in the Marine Environment and the Associated Metallic Elements,
W73-11184 5B

PINNEKER, YE. V.
Distribution and Composition of Mineral Water in the Tuva Autonomous Republic (Zakonomernosti rasprostraneniya i sostav podzemnykh mineral'nykh vod Tuvy),
W73-11412 2F

PLATTE, J. A.
Atomic Absorption Spectrophotometry as a Tool for the Water Chemist,
W73-11294 5A

POOLE, D. H.
An Evaluation of the Utility of Available Remote Sensor Returns for a Study of Slope Failure Phenomena,
W73-11216 7B

PORTER, J. J.
A Study of the Photodegradation of Commercial Dyes,
W73-11325 5B

POSNER, M.
Dispersion and Miscible Displacement,
W73-11167 3A

POTTER, G. D.
Metabolism of Tritiated Water in the Dairy Cow,
W73-11186 5B

POUSCHINE, L.
Ultra High Rate Filtration of Activated Sludge Plant Effluent,
W73-11337 5D

POWELL, J. K.
A Control System for Mill Effluent Disposal,
W73-11312 5G

POWERS, W. F.
Water Quality Models for Total Coliform,
W73-11135 5B

PREIS, W. R.
Apparatus for Treating Sewage,
W73-11231 5D

PRIETO-BOUZA, A.
Volumetric Determination of Nickel by High Frequency Impedimetry,
W73-11127 5A

PROKOF'YEV, O. N.
Handbook of Toxic Chemicals (Second Edition, Revised and Supplemented),
W73-11554 5C

PROPHETER, O. W.
Neutron Activation Analysis of Bottom Sediments,
W73-11067 5A

PROVOST, M. W.
Environmental Hazards in the Control of Disease Vectors,
W73-11182 5C

PRZEDECKI, T.
A Small Dimension Probe for the Determination of Ground Water Flow Direction,
W73-11200 2F

PURUSHOTHAMAN, K.
Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri,
W73-11271 5C

The Lead Industry as a Source of Trace Metals in the Environment,
W73-11269 5B

PYRIH, R. Z.
Determination of Trace Mercury in Soil and Rock Media,
W73-11297 5A

PYTKOWICZ, R. M.
The Chemical Stability of the Oceans and the CO₂ System,
W73-11374 2K

QUADRINI, D. A.
Waste Water Sampler,
W73-11243 5A

QUINN, J. G.
Petroleum Hydrocarbons and Fatty Acids in Wastewater Effluents,
W73-11575 5B

QUISENBERRY, V. L. JR
Capillary-Diffusion and Self-Diffusion of Liquid Water in Unsaturated Soils,
W73-11390 2G

RAGAN, R. M.
Behavior of Groundwater Flow Subject to Time-Varying Recharge,
W73-11142 2F

RAHILL, R. L.
Lithium in Surficial Materials of the Continental United States and Partial Data on Cadmium,
W73-11268 5B

RAHN, K.
Diurnal Variation of Aerosol Trace Element Concentrations in Livermore, California,
W73-11277 5B

RAHN, K. A.
Areawide Trace Metal Concentrations Measured by Multielement Neutron Activation

AUTHOR INDEX

ROSS, D.

Analysis - A One Day Study in Northwest Indiana, W73-11278	5B	RICE, L. C. BOD: Determining the Necessary Dilution Technique, W73-11661	5A	ROBINS, M. L. MSB Computerized Combined Sewer Control System, W73-11673	5G
RAINS, T. C. Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material, W73-11339	5A	RICE, T. R. Cycling of Elements of Estuaries, W73-11645	5B	ROBISON, T. M. Water Records of the U.S. Virgin Islands, 1962-69, W73-11396	2E
RALLS, J. W. Low Water Volume Enzyme Deactivation of Vegetables Before Preservation, W73-11330	5D	RICHARDS, F. A. Oxygen Deficient Conditions and Nitrate Reduction in the Eastern Tropical North Pacific Ocean, W73-11589	5A	ROBLES, E. G. JR Water Sampling Guidelines and Interpretation of Data, W73-11205	7A
RALSTON, H. R. Diurnal Variation of Aerosol Trace Element Concentrations in Livermore, California, W73-11277	5B	RICHARDSON, R. L. DDT, DDE, and Polychlorinated Biphenyls in Biota From the Gulf of Mexico and Caribbean Sea-1971, W73-11580	5B	ROGERS, L. C. New Bits Can Drill More Hole, W73-11457	8B
RAMARAJU, T. S. 'Benduvala,' A Special Gear for Catching Major Carp <i>Labeo Fimbriatus</i> (Bloch) in Godavari River, with Observations on 'Benduvala' Fishery at Dummagudem, W73-11405	8I	RICKLIS, J. Development and Preliminary Design of a Sorbent-Oil Recovery System, W73-11071	5G	New Down-Hole Tools Improve Drilling, W73-11458	8B
RAMIREZ, A. Effect of Soil, Cover, Slope, and Rainfall Factors on Soil and Phosphorus Movement Under Simulated Rainfall Conditions, W73-11208	5B	RILEY, J. P. Distribution of Dissolved Mercury in the Irish Sea, W73-11293	5B	Rotary Rig Due for Face-Lifting, W73-11459	8B
RASIN, V. J. JR Sublethal Effects of Baltimore Harbor Water on the White Perch, <i>Morone americana</i> , and the Hogchoker, <i>Trinectes maculatus</i> , W73-11652	5C	RIPPEE, K. P. Pesticides in Water, W73-11618	5B	ROGERS, P. Qualitative Values in Environmental Planning: A Study of Resource Use in Urbanizing Watersheds, W73-11253	5G
RAUT, T. B. Morphology and Distribution of Soils of Lower Ib Watershed, W73-11258	2G	RITTER, J. R. Sand Transport by the Eel River and Its Effect on Nearby Beaches, W73-11559	2L	ROHDE, H. Determination of Mercury Contents in Diverse Samples of Fish and Other Biological Materials by Neutron Activation Analysis, (Neutronenaktivierungsanalytische Bestimmungen von Quecksilbergehalten in Diversen Fischproben und anderen Biologischen Materialien), W73-11123	5A
REDEKOPP, A. B. Systems Approach to Training and Licensing of Water Works Personnel in Ontario, W73-11676	5F	ROBBINS, J. A. Areawide Trace Metal Concentrations Measured by Multielement Neutron Activation Analysis - A One Day Study in Northwest Indiana, W73-11278	5B	ROLFE, S. T. Designing to Prevent Brittle Fractures in Bridges, W73-11525	8G
REED, L. A. Effects of Roadway and Pond Construction on Sediment Yield Near Harrisburg, Pennsylvania, W73-11700	2J	ROBERTS, A. C. Shore Termination for Oil Spill Booms, W73-11437	5G	ROMANENKO, V. A. Investigation of the Dynamics and Calculation of the Losses of Spring Runoff in a Small River Basin (Issledovaniye dinamiki i raschet poter' vesennego stoka s malom rechnom basseyne), W73-11690	2E
REED, P. A. Progress Report on Water Quality of Lake Michigan Near Chicago, W73-11581	5B	ROBERTS, E. J. Using Fire Streams With a Self-Propelled Oil Spill Skimmer, W73-11434	5G	ROMSTAD, K. A. Public Participation in Urban Water Planning, W73-11257	6B
REIMER, P. O. Urbanization's Drainage Consequence, W73-11254	4C	ROBERTS, E. J. Removal of Mercury from Aqueous Solutions by Nitrogen-Containing Chemically Modified Cotton, W73-11174	5D	ROOK, H. L. Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material, W73-11339	5A
REINHEIMER, C. J. Aerial Surveillance Spill Prevention System, W73-11326	5B	ROBERTS, M. H. JR Environmental Effects on Toxaphene Toxicity to Selected Fishes and Crustaceans, W73-11323	5C	ROQUES, H. De-Oiling of Polluted Waters, W73-11226	5D
REMPEL, G. Ozone for Supplementary Water Treatment, W73-11677	5F	ROBERTS, W. F. Marine Sanitation System Demonstration, W73-11059	5D	ROSA, F. Centrifugal Distillation System, W73-11223	3A
REUMMLER, W. P. Recover Zinc From Zinc Ash, W73-11281	5D	ROBERTSON, F. P. Bituminous Blanket for Dike at Ludington Pumped Storage Project, W73-11504	8F	ROSENBERG, D. G. Helicopter Application of Copper Sulfate, W73-11419	5F
REVZON, A. I. Principles of Landslide Identification from Aerial Survey Data (Printsipy raspoznavaniya opolznevyykh protsessov po materialam aerofotos'yemki), W73-11100	2J	ROBICHEAUX, W. J. Skimming Device for use on a Liquid Surface, W73-11233	5D	ROSENE, R. W. Radial Collector Well Solves Water Supply Problem, W73-11473	8B
				ROSS, D. The Role of Desalting in Providing High Quality Water for Industrial Use, W73-11164	3A

AUTHOR INDEX

ROTHE, P.

ROTHE, P.
Sedimentation in the Deep-Sea Areas Adjacent
to the Canary and Cape Verde Islands,
W73-11393 2J

ROWE, C. H.
Water Purification With Porous Abrasives,
W73-11228 5D

ROWLAND, S. P.
Removal of Mercury from Aqueous Solutions
by Nitrogen-Containing Chemically Modified
Cotton,
W73-11174 5D

RUDDER, C. L.
Aerial Surveillance Spill Prevention System,
W73-11326 5B

RUDOMETOV, M. V.
Forecasting Quarterly Inflow of Water to
Dnieper River Reservoirs During the Cold Half
of the Year (O prognozirovanií kvartal'nogo
prirodnego vody v dneprovskiy vodokhranilishche
za khodnutyu polovinu goda),
W73-11691 2H

RUF, H.
Determination of Mercury Contents in Diverse
Samples of Fish and Other Biological Materials
by Neutron Activation Analysis, (Neutronenaktivierungsanalytische Bestimmungen von
Quecksilbergehalten in Diversen Fischproben
und anderen Biologischen Materialien),
W73-11123 5A

RUMPF, E.
Solution of Problems on Interconnected AC
Systems by Means of HVDC Transmission
Systems,
W73-11521 8C

RUSH, F. E.
Bathymetric Reconnaissance of Lake Tahoe,
Nevada and California,
W73-11531 2H

RUSSELL, J. M. III
The Inference of Atmospheric Ozone Using
Satellite Nadir Measurements in the 1042/CM
Band,
W73-11400 7B

RUSSELL, P.
Heavy Metals: Fallout Around a Power Plant,
W73-11282 5A

RUSSELL, T. W. F.
Reactor Model Parameters - Two-Phase Reactor
Design Tubular Reactors,
W73-11138 5F

RUTKOWSKI, M. D.
Liquid Sampling,
W73-11235 7B

SACKETT, W. M.
DDT, DDE, and Polychlorinated Biphenyls in
Biota From the Gulf of Mexico and Caribbean
Sea-1971,
W73-11580 5B

SADOV, A. V.
Principles of Landslide Identification from
Aerial Survey Data (Printsy raspoznavaniya
opolznevnykh protsessov po materialam
aerofotos'zemki),
W73-11100 2J

SAFFORD, G. J.
A Neutron Spectroscopic Study of the Diffusive
Kinetics and Interactions of Water in
Dense Layer Desalination Membranes,
W73-11165 3A

SAKAMOTO, C. M.
Freeze-Free (32 F) Seasons of the Major
Basins and Plateaus of Nevada,
W73-11218 7C

SALMAN, H. A.
Progress Report of Residue Studies on Organic
Arsenicals used for Ditchbank Weed Control,
W73-11497 4A

SALMON, L.
Trace Elements in the Atmospheric Environment,
W73-11299 5A

SANKARASUBRAMANIAN, R.
Dispersion and Miscible Displacement,
W73-11167 3A

SANN-MYINT, K.
The Bacteriology of the Water Supplies of Ran-
goon: II. Cool Dry and Hot Dry Seasons,
W73-11630 5C

SANTIAGO, M. A.
Spring Phytoplankton Abundance and Productivity
in Grand Traverse Bay, Lake Michigan,
1970,
W73-11629 5B

SARTOR, J. D.
Oil/Sorbent Harvesting System for Use on Ves-
sels of Opportunity,
W73-11445 5G

SAUER, R. L.
Apollo Experience Report, Potable Water
System,
W73-11202 5F

SAYRE, D. M.
Effects of Urbanization on Floods in the
Houston, Texas, Metropolitan Area,
W73-11402 4C

SCHAAKE, J. C. JR
Disaggregation Processes in Stochastic
Hydrology,
W73-11141 2E

SCHEKEL, K. A.
Water Potentials in Nonwilted Dianthus Grown
in Different Nutrient Solution Concentrations,
W73-11191 2I

SCHELL, K. F.
Application of Remote Sensing Techniques to
Measurement of Use of Outdoor Recreation
Resources,
W73-11546 7B

SCHELSKE, C. L.
Spring Phytoplankton Abundance and Productivity
in Grand Traverse Bay, Lake Michigan,
1970,
W73-11629 5B

SCHIMKE, G. R.
Assessing the Water Pollution Potential of
Manufactured Products,
W73-11334 5B

SCHMIDT, C. J.
The Role of Desalting in Providing High Quality
Water for Industrial Use,
W73-11164 3A

SCHMIDT, R. L.
Phosphorus Release from Lake Sediments,
W73-11072 5C

SCHROEDER, H. A.
Toxic Effects of Trace Elements on the
Reproduction of Mice and Rats,
W73-11190 5C

Trace Elements in the Human Environment,
W73-11304 5B

SCHUMAN, G. E.
Phosphorus Losses From Four Agricultural
Watersheds on Missouri Valley Loess,
W73-11209 5B

SCHWERDTFEGER, W. J.
Highly Resistant Copper Deteriorates in
Severely Corrosive Soils,
W73-11454 8G

SCOTT, K. M.
Scour and Fill in Tujunga Wash--A Fanhead
Valley in Urban Southern California--1969,
W73-11550 2J

SCRIVEN, J.
Microstraining Removes Algae and Cuts Filter
Back-Washing,
W73-11450 5F

SEDWICK, P. A.
Infant Mortality and Hardness of Local Water
Supplies,
W73-11144 5C

SEDRICK, A. V.
Wet Well Woes,
W73-11462 8A

SEIM, E. C.
Influence of Agricultural Practices on Water
Quality in Nebraska: A Survey of Streams,
Groundwater, and Precipitation,
W73-11696 5B

SEITZ, W. R.
Anodic Stripping Voltammetry at a Tubular
Mercury-Covered Graphite Electrode,
W73-11484 5A

SENN, V. J.
Mass Spectrometric Identification of Some bis-
2,4-Dinitrophenylhydrazones,
W73-11487 5A

SHACKLETTE, H. T.
Lithium in Surficial Materials of the Contiguous
United States and Partial Data on Cadmium,
W73-11268 5B

SHANE, M. S.
How to Black Out Algae,
W73-11420 5F

Pollution Effects on Phycovirus and Host
Algae Ecology,
W73-11635 5C

SHARR, J.
Research on Piezodialysis, Third Report,
W73-11154 3A

SHAstry, J. S.
Nonlinear Parameter Estimation in Water
Quality Modeling,
W73-11361 5B

AUTHOR INDEX

SPRENGER, R. M.

- SHAURETT, M.**
Movement of Acarol and Terbicil Pesticides During Displacement Through Columns of Wabasso Fine Sand, W73-11537 5B
- SCHERBAK, A. V.**
Characteristics of Ice-Jam Formation on the Soviet Reach of The Danube (Osobennosti zatoroobrazovaniya na sovetskem uchastke Dunaya), W73-11694 2C
- SHECHTER, H.**
Spectrophotometric Method for Determination of Ozone in Aqueous Solutions, W73-11495 5A
- SHENDE, N. K.**
Morphology and Distribution of Soils of Lower Ib Watershed, W73-11258 2G
- SHIH, S. F.**
Water Requirements for Optimum Crop Yield, W73-11507 3F
- SHOREY, W. K.**
Macrobenthic Ecology of a Sawdust-Bearing Substrate in the Penobscot River Estuary (Maine), W73-11602 5C
- SHIRRAM, C. R.**
Abnormal Pressures in Deep Wells of Southwestern Louisiana, W73-11464 8E
- SHULTS, W. D.**
Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection, W73-11606 5A
- SHUMWAY, D. L.**
Development of Dissolved Oxygen Criteria for Freshwater Fish, W73-11327 5C
- Impairment of the Flavor of Fish by Water Pollutants, W73-11322 5C
- SIEGELMAN, G.**
Spray Freezing, Decanting, Melting and Hydrolysis as Related to Secondary Refrigerant Desalting, W73-11158 3A
- SILVEY, J. K. G.**
Nutrient Ratio Variation in Reservoir Sediments, W73-11591 5B
- SIMO NEE BARCZY, Z.**
Process for the Removal of Cyanide from Sewage by Means of Formaldehyde, W73-11224 5D
- SINGH, Y. P.**
Fertilizer Response to the Physical Effects of Soil Compaction, W73-11280 3F
- SINUO, P.**
Study of the Behavior of a Roof with Various Bolting Systems, W73-11503 8E
- SIVASAMI, K. S.**
Minimum Flow in the Iberian Peninsula (Minimal'nyy stok rek Pireneyskogo polusotrova), W73-11098 2E
- SKAAR, H.**
Lead Accumulation Within Nuclei of Moss Leaf Cells, W73-11276 5E
- SKINNER, E. L.**
Ground-Water Quality in Wisconsin Through 1972, W73-11568 2F
- SKOGERBOE, G. V.**
Rehabilitation of Irrigation Systems for Salinity Control, W73-11509 3F
- SKOPINTSEV, B.**
On The Age of Stable Organic Matter—Aquatic Humus in Oceanic Waters, W73-11379 5B
- SLIWICKI, J.**
Alpha-Al203 as an Adsorbent in Thin-Layer Chromatography, W73-11128 5A
- SLY, P. G.**
Research and the Problems of Two Seas, W73-11350 2L
- SMITH, A.**
Fallout of Sodium Sulphate near a Kraft Mill, W73-11175 5A
- SMITH, D. B.**
Physical Erosion and Denudation Rates in Cartwright Basin and Vicinity, Williamson County, Tennessee, W73-11140 2J
- SMITH, M. J.**
Copper Determination in Water by Standard Addition Potentiometry, W73-11605 5A
- SMITH, R.**
Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish, W73-11279 5B
- SMITH, S. R.**
Location and Determination of Depths of Surface Undulations by Seismic Methods, W73-11398 8E
- SMITH, S. V.**
Carbon Dioxide Dynamics: A Record of Organic Carbon Production, Respiration, and Calcification in the Eniwetok Reef Flat Community, W73-11488 5A
- SMITH, W. E.**
A Cyprinodont Fish, *Jordanella floridae*, as a Laboratory Animal for Rapid Chronic Bioassays, W73-11598 5C
- SMYTH, S. J.**
Comprehensive Regional Water and Sewer Inventory and Analysis, W73-11670 7B
- SNEED, R. E.**
Water Requirements for Optimum Crop Yield, W73-11507 3F
- SOKOLOVA, V. M.**
Moisture Transfer and Frost Heave in Loams, W73-11193 2G
- SOLOPENKO, L. I.**
Forecasting Time of Formation of Complete Ice Cover in the Upper Dnieper Basin (O prognozirovaniu srokov nastupleniya ledostava v basseyne Verkhnego Dnepra), W73-11695 2C
- SOLTERO, R. A.**
Limnology of Yellowtail Reservoir and the Big Horn River, W73-11331 5C
- SOMMERVILLE, R. C.**
Ozone for Supplementary Water Treatment, W73-11677 5F
- SONIN, A. A.**
Ion Transport Through Layered Ion Exchange Membranes, W73-11160 3A
- Membrane Fouling in Electrodialysis: A Model and Experiments, W73-11163 3A
- SORIANO, C. A.**
Water Decomposition Apparatus, W73-11234 5F
- SORBERGER, G. C.**
Combined Effect of Thermal and Organic Pollution on Oxygen Sag Curve, W73-11423 5C
- SOROKIN, Y. I.**
Microbial Activity as a Biogeochemical Factor in the Ocean, W73-11378 5B
- Trophic Role of Bacteria in the Ecosystem of the Coral Reef, W73-11632 5A
- SOSEDKO, M. N.**
Experiment in the Use of Digital Computers to Determine Traveltime on a Tributary Reach of A River (Opty spol'zovaniyu ETsVM pri opredelenii vremeni dobeganiya na pritochnom uchastke reki), W73-11692 2E
- SOUTHWELL, G. R.**
Corrosion of Metals in Tropical Environments—Copper and Wrought Copper Alloys, W73-11455 8G
- SOWELL, R. S.**
Water Requirements for Optimum Crop Yield, W73-11507 3F
- SPECTOR, M. L.**
Activated Sludge Sewage Treatment Process and System, W73-11239 5D
- SPOMER, R. G.**
Phosphorus Losses From Four Agricultural Watersheds on Missouri Valley Loess, W73-11209 5B
- SPOONER, C. M.**
Major and Trace Element Loading of Central Michigan Lakes, W73-11427 5B
- SPRENGER, R. M.**
Continuous Observations of the Structural Changes in Deforming Polycrystalline Ice, W73-11556 2C

AUTHOR INDEX

SPRENT, J. I.

SPRENT, J. I.
The Effects of Water Stress on Nitrogen-fixing Root Nodules: II. Effects of the Fine Structure of Detached Soybean Nodules, W73-11415 3F

The Effects of Water Stress on Nitrogen-fixing Root Nodules: III. Effects of Osmotically Applied Stress, W73-11416 3F

SPRINGER, G. S.
A Model for Rain Erosion of Homogeneous Materials, W73-11560 8G

STANFORD, J. A.
A Centrifuge Method for Determining Live Weights of Aquatic Insect Larvae, with a Note on Weight Loss in Preservative, W73-11647 5A

STANKOVIC, M. K.
Biochemical Tests for the Appraisal of Exposure to Lead, W73-11309 5C

STANLEY, E. M.
The Thermal Conductivity of Pure Water and Standard Sea Water as a Function of Pressure and Temperature: Part II—Pure Water, W73-11084 2K

STANLEY, J. B.
Mass Spectrometric Identification of Some bis-2,4-Dinitrophenylhydrazones, W73-11487 5A

STANLEY, R. K.
Liquid Sampling, W73-11235 7B

STEELE, J. H.
Factors Controlling Marine Ecosystems, W73-11380 5C

STEINITZ, C.
Qualitative Values in Environmental Planning: A Study of Resource Use in Urbanizing Watersheds, W73-11253 5G

STEPAKOFF, G.
Spray Freezing, Decanting, Melting and Hydrolysis as Related to Secondary Refrigerant Desalting, W73-11158 3A

STEPHENS, G. R.
Lead Emissions from Incinerated Sewage Sludge Detected on Tree Foliage, W73-11302 5A

STEPHENS, L.
Development and Preliminary Design of a Sorbent-Oil Recovery System, W73-11071 5G

STEPHENS, R. W.
Design and Installation of Deep Anode Groundbeds, W73-11480 8B

STEVEN, H. H. JR
Radionuclides in Transport in the Columbia River from Pasco to Vancouver, Washington, W73-11549 5B

STEVENS, R. F.
Internal Cracking in Reinforced Concrete Members, W73-11523 8F

STEWART, P. L.
Incidence of Mercury in Illinois Pheasants, W73-11305 5A

STICKNEY, R.
Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish, W73-11279 5B

STILLWELL, R. N.
New Picogram Detection System Based on a Mass Spectrometer With an External Ionization Source at Atmospheric Pressure, W73-11608 5A

STOERMER, E. F.
Spring Phytoplankton Abundance and Productivity in Grand Traverse Bay, Lake Michigan, 1970, W73-11629 5B

STRAND, J. R.
Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington, W73-11204 5B

STUMES, P.
Iron Bacteria—A Likely Subject of Co-ordinated Research, W73-11471 5B

STUMM, W.
The Acceleration of the Hydrogeochemical Cycling of Phosphorus, W73-11385 5B

STURM, R. N.
Survival and Gill Condition of Bluegill (*Lepomis macrochirus*) and Fathead Minnows (*Pimephales promelas*) Exposed to Sodium Nitrilotriacetate (NTA) for 28 Days, W73-11621 5C

SUGIHARA, H.
Epidemiological Study on *Clondorchis sinensis* Around Lake Biwa, Shiga Prefecture: I. Survey on Distribution of *Parafossarulus Manchouicus*, The First Intermediate Host Snail (In Japanese), W73-11654 2H

SULINSKI, S. J.
Construction Difficulty Index for Tunnel Construction, W73-11681 8H

SULLIVAN, W. T.
Mercury in Public Sewer Systems, W73-11585 5D

SUMMERS, A. D.
Progress Report of Residue Studies on Organic Arsenicals used for Ditchbank Weed Control, W73-11497 4A

SUMMERS, A. O.
Volatilization of Mercuric Chloride by Mercury-Resistant Plasmid-Bearing Strains of *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*, W73-11286 5B

SUNDAR, L.
Mercury in Public Sewer Systems, W73-11585 5D

SUWANDI, M. S.
The Growth Rate of Ice Crystals: The Properties of Carbon Dioxide Hydrate A Review of Properties of 51 Gas Hydrates, W73-11156 3A

SUZUKI, R.
Survival Potential of F1 Hybrids Among Salmonid Fishes, W73-11653 8I

SVITOCH, A. A.
Rate of Retreat of Yuzhno-Chuya Glaciers in the Gorno-Altai Autonomous Oblast (O skorosti otstupaniya lednikov Yuzhno-Chuyskih belkov Gornogo Altaia), W73-11097 2C

SYMONS, F.
Study of the Changes in the Structure of Two Algal Populations: An R-Type Factor Analysis, W73-11129 5A

SZTROMAJER, S.
A Small Dimension Probe for the Determination of Ground Water Flow Direction, W73-11200 2F

TAFT, J. H.
Application of Remote Sensing Techniques to Measurement of Use of Outdoor Recreation Resources, W73-11546 7B

TAKAHASHI, M.
Studies on the Sources of Pollution in Dairy Water: I. Properties of the Waste Water From Potato Starch Factories (in Japanese), W73-11284 5B

TAYLOR, F.
Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish, W73-11279 5B

TAYLOR, J. K.
Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material, W73-11339 5A

TEISINGER, J.
Prague International Lead Panel: Effects of Atmospheric Lead on Biological Systems, W73-11265 5C

TER HAAR, G. L.
Composition of Airborne Lead Particles, W73-11188 5A

THACKSTON, E. L.
Secondary Waste Treatment for a Small Diversified Tannery, W73-11340 5D

THAKORE, A. N.
Identification of the Constituents of Kraft Pulping Effluent That are Toxic to Juvenile Coho Salmon (*Oncorhynchus kisutch*), W73-11638 5A

THOMAS, R. H.
A Flow Proportional Composite Sampler, W73-11463 5A

THOMAS, W. H.
Nutrient Inversions in the Southeastern Tropical Pacific Ocean, W73-11587 2L

THOMPSON, D. R.
Hydrogeologic Considerations for Sealing Coal Mines, W73-11675 5G

THOMPSON, M. J.
Ecological Monitoring of Two Beach Nourishment Projects in Broward County, Florida, W73-11528 2J

AUTHOR INDEX

VORHIS, R. C.

THOMPSON, R. J. Biological Removal of Carbon and Nitrogen Compounds from Coke Plant Wastes, W73-11328	TROY, J. C. Oxidation of Pyrites in Chlorinated Solvents, W73-11068	VAN NIEROP, E. T. Watershed Research, W73-11534
5D	5D	2A
THOMPSON, T. H. Reservoir Bank Storage, W73-11542	TSENG, M. T. Behavior of Groundwater Flow Subject to Time-Varying Recharge, W73-11142	VAN NOORLE JANSEN, L. M. Occurrence of <i>Salmonella</i> in Oxidation Ditches, W73-11136
2H	2F	5A
THOMSON, F. J. Applications of Multispectral Remote Sensing Techniques to Hydrobiological Investigations In Everglades National Park, W73-11553	TU, M. The Bacteriology of the Water Supplies of Rangoon: II. Cool Dry and Hot Dry Seasons, W73-11630	VANDERHOLM, D. H. Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management, W73-11150
7B	5C	5G
THOMSON, N. S. Applications of Multispectral Remote Sensing Techniques to Hydrobiological Investigations In Everglades National Park, W73-11553	TUCKER, R. Natural Resource Information System Remote Sensing Studies, W73-11571	VARADE, S. B. Measurement of Contact Angle of Water in Soils and Sand, W73-11273
7B	7B	2G
THORNTON, G. L. An Individual Approach to Independent Computer Survey, W73-11512	TURCSAN, I. Process for the Removal of Cyanide from Sewage by Means of Formaldehyde, W73-11224	VARNES, A. W. Selective Determination of Copper (II) In Aqueous Media by Enhancement of Flash-Photolytically Initiated Riboflavin Chemiluminescence, W73-11636
7C	5D	5A
TILLEY, L. J. Measurement of Salt-Wedge Excursion Distance in the Duwamish River Estuary, Seattle, Washington, by Means of the Dissolved-Oxygen Gradient, W73-11564	TURNER, N. C. Comparison of Simulated and Actual Evaporation From Maize and Soil in a Lysimeter, W73-11201	VASKOVSKY, V. E. Arsenic in the Lipid Extracts of Marine Invertebrates, W73-11189
5B	2D	5C
TINCELIN, E. Study of the Behavior of a Roof with Various Bolting Systems, W73-11503	TURNER, S. E. Physical-Chemical Oceanographic Data from the North Pacific Ocean and Bering Sea, 1971, W73-11595	VATTUONE, G. M. Metabolism of Tritiated Water in the Dairy Cow, W73-11186
8E	5A	5B
TOEBES, G. H. Iterative Simulation Algorithm in Reservoir Systems Operation, W73-11139	TURRE, G. J. 60-MGD Microtraining Plant Meets Denver's Growing Needs, W73-11667	VAUGHN, J. C. Progress Report on Water Quality of Lake Michigan Near Chicago, W73-11581
4A	5F	5B
TORMA, A. E. Oxidation of Copper (II) Selenide by Thiobacillus Ferrooxidans, W73-11171	TYLEY, S. J. Artificial Recharge in the Whitewater River Area, Palm Springs, California, W73-11565	VAZHNOV, A. N. Investigation of Seasonal Variability of Runoff on Rivers in the Altay and Sayan Mountain Systems (Issledovaniye vnutrigodovoy neravnomennosti stoka rek Altaya i Sayan), W73-11101
5C	4B	2E
TOWNSHEND, A. Trace Analysis by Enzyme Inhibition and Activation, W73-11604	VAGIN, N. F. Characteristics of Ice-Jam Formation on the Soviet Reach of The Danube (Osobennosti zatorobrazovaniya na sovetskoy uchastke Dunayi), W73-11694	VERONIS, G. Physical Models of Large Scale Ocean Circulation, W73-11368
5A	2C	2E
TRANTER, W. H. An Investigation of Environmental Pollution by Lead and Other Heavy Metals from Industrial Development in Southeastern Missouri, W73-11270	VALENCIA, R. D. Disaggregation Processes in Stochastic Hydrology, W73-11141	VIALLEX, G. Sea Fish Contamination With Mercury (Contamination des poissons de mer par le mercure), W73-11289
5B	2E	5C
TRAPP, H. JR Availability of Groundwater for Public-Water Supply in Central and Southern Escambia County, Florida: Interim Report, July 1972, W73-11563	VALERI, V. R. Assessing the Water Pollution Potential of Manufactured Products, W73-11334	VLAHAKIS, J. G. The Growth Rate of Ice Crystals: The Properties of Carbon Dioxide Hydrate A Review of Properties of 51 Gas Hydrates, W73-11156
2F	5B	3A
TRENT, D. S. Numerical Thermal Plume Model for Vertical Outfalls in Shallow Water, W73-11333	VAN DER SCHALIE, H. The Effects of Temperature on Growth and Reproduction of Aquatic Snails, W73-11444	VOLK, J. C. JR Marine Sanitation System Demonstration, W73-11059
5B	5C	5D
TROEMPER, A. P. Reduction of Hydraulic Sewer Loadings by Downspout Removal, W73-11671	VAN DER WATT, H. V. H. Relationships between Moisture Retention and Particle Size Distribution of the Soil, W73-11634	VOLKOV, I. I. Role of Iron Sulfides in the Accumulation of Trace Elements in Black Sea Sediments (Rol'sul'fidov zheleza pri nakoplenii mikroelementov v osadkakh Chernogo morya), W73-11409
4A	2G	2J
TROUP, B. N. Phosphate in Interstitial Waters of Anoxic Sediments: Oxidation Effects During Sampling Procedure, W73-11118	VAN MONFRANS, J. Ecological Monitoring of Two Beach Nourishment Projects in Broward County, Florida, W73-11528	VORHIS, R. C. Seismic Seiches in Bays, Channels, and Estuaries, W73-11532
5B	2J	2H

AUTHOR INDEX

WAGGONER, P. E.

- WAGGONER, P. E.**
Comparison of Simulated and Actual Evaporation From Maize and Soil in a Lysimeter, W73-11201 2D
- WAGNER, C. C.**
Fish and Food Organisms in Acid Mine Waters of Pennsylvania, W73-11332 5C
- WAHLBERG, A.**
Low pH Values Shown to Affect Developing Fish Eggs (*Brachydanio rerio* Ham.-Buch.), W73-11651 5C
- WALKER, W. R.**
Rehabilitation of Irrigation Systems for Salinity Control, W73-11509 3F
- WALL, W. J. JR**
Dursban (Trademark) and Diazinon Residues in Biotia Following Treatment of Intertidal Plots on Cape Cod - 1967-69, W73-11627 5C
- WALSH, S.**
Least Cost Method for Sewer Design, W73-11360 5G
- WALTON, A.**
Dispersed and Particulate Petroleum Residues in the Gulf of St. Lawrence, W73-11612 5B
- WALTON, C. J.**
Mercury, DDT, and PCB in Harbour Seals (*Phoca vitulina*) From the Bay of Fundy and Gulf of Maine, W73-11577 5C
- WARD, R. C.**
Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management, W73-11150 5G
- WARREN, C. E.**
Development of Dissolved Oxygen Criteria for Freshwater Fish, W73-11327 5C
- WARRICK, A. W.**
Steady-State Seepage in a Hillside, W73-11212 2G
- WEBB, P. W.**
Effects of Sublethal Concentrations of Sodium Pentachlorophenate on Growth Rate, Food Conversion Efficiency, and Swimming Performance in Underyearling Sockeye Salmon (*Oncorhynchus nerka*), W73-11656 5C
- WEDEMEYER, W. G.**
Financing Private Water Resource Development: Analysis of a State Loan Program, W73-11686 3F
- WEEKS, W. F.**
Towing Icebergs to Irrigate Arid Lands--Manna or Madness, W73-11566 6F
- WEGRZYNEK, J.**
Alpha-Al203 as an Adsorbent in Thin-Layer Chromatography, W73-11128 5A
- WEHRY, E. L.**
Selective Determination of Copper (II) In Aqueous Media by Enhancement of Flash-

- Photolytically Initiated Riboflavin Chemiluminescence, W73-11636 5A
- WEINGARDEN, M. J.**
Ozonation of Microstrained Secondary Effluent, W73-111678 5D
- WEISS, H. V.**
Mercury in the Marine Environment: Concentration in Sea Water and in a Pelagic Food Chain, W73-11300 5C
- WELLER, G.**
A Catalog of Hydroclimatological Data for Alaska's Coastal Zone, W73-11056 2B
- WELTY, J. R.**
Numerical Thermal Plume Model for Vertical Outfalls in Shallow Water, W73-11333 5B
- WESOLOWSKI, J. J.**
Diurnal Variation of Aerosol Trace Element Concentrations in Livermore, California, W73-11277 5B
- WEST, L. H.**
Cathodic Protection--The Answer to Corrosion Prevention of Underground Structures, W73-11477 8G
- WEST, S. W.**
Disposal of Uranium-Mill Effluent by Well Injection in the Grants Area, Valencia County, New Mexico, W73-11551 5E
- WESTERN, S.**
The Classification of Arid Zone Soils: I. An Approach to the Classification of Arid Zone Soils Using Depositional Features, W73-11417 2G
- The Classification of Arid Zone Soils: II. The Classification of Sedosols in South Arabia, W73-11418 2G
- WESTPHAL, J. A.**
Hydrology of Truckee Meadows, Nevada, W73-11430 4B
- WEYL, P. K.**
Hydrographic Study of the Shelf and Slope Waters of New York Bight, W73-11110 2E
- WEYRICK, R. R.**
Linear Programming use for Evaluating Water Resources and Cost and Benefit Allocation, W73-11683 6A
- WHEELER, J. E.**
Influence of Soil Temperature and Moisture on Survival and Growth of Strands of *Phymatotrichum omnivorum*, W73-11248 3F
- WHEELER, W. B.**
Movement of Acarol and Terbicil Pesticides During Displacement Through Columns of Wabasso Fine Sand, W73-11537 5B
- WHILMAN, I.**
An Environmental Evaluation System for Water Resource Planning, W73-11151 6A
- WHITE, D.**
Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish, W73-11279 5B
- WHITE, D. A.**
Pesticides in Water, W73-11618 5B
- WIEGERT, R. G.**
Ecology of Yellowstone Thermal Effluent Systems: Intersects of Blue-Green Algae, Grazing Flies (*Paracoenia*, *Ephydriidae*) and Water Mites (*Partunilia*, *Hydrachnidae*), W73-11131 5C
- WILDER, I.**
Standard Dispersant Effectiveness and Toxicity Tests, W73-11442 5A
- WILDUNG, R. E.**
Phosphorus Release from Lake Sediments, W73-11072 5C
- WILLEKE, G. E.**
Theory and Practice of Public Participation in Planning, W73-11510 6B
- WILLIAMS, E. R.**
Application of the Fluorescent Antibody Technique to the Differentiation of *Aspergillus* Species, *Candida* Species and Zygomycetes in Paraffin Section of Formalin-Fixed Tissues, W73-11126 5A
- WILLIAMS, P. M.**
Mercury in the Marine Environment: Concentration in Sea Water and in a Pelagic Food Chain, W73-11300 5C
- WILLIAMS, V.**
Natural Resource Information System Remote Sensing Studies, W73-11571 7B
- WILLIAMSON, J. D.**
Onshore-Offshore Sand Transport on Del Monte Beach, California, W73-11086 2J
- WILSON, K. W.**
A Continuous-Flow Apparatus for Assessing the Toxicity of Substances to Marine Animals, W73-11169 5C
- WILSON, R. H.**
Toward a Philosophy of Planning: Attitudes of Federal Water Planners, W73-11073 6A
- WINCHESTER, J. W.**
Areawide Trace Metal Concentrations Measured by Multielement Neutron Activation Analysis - A One Day Study in Northwest Indiana, W73-11278 5B
- WINDHAM, D.**
Watershed Research, W73-11534 2A
- WINDOM, H.**
Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish, W73-11279 5B
- WITHEROW, J. L.**
National Meat-Packaging Waste Management Research and Development Program, W73-11440 5D

AUTHOR INDEX

ZIEVERS, J. F.

WITHERUP, S. O.		
Trace Metal Content of Hair, I. Zinc and copper Content of Human Hair in Relation to Age and Sex, W73-11308	5A	
WITTENBERG, S. J.		
A Water System Designed to Attract Industry, W73-11317	5F	
WIXSON, B. G.		
Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri, W73-11271	5C	
An Investigation of Environmental Pollution by Lead and Other Heavy Metals from Industrial Development in Southeastern Missouri, W73-11270	5B	
The Lead Industry as a Source of Trace Metals in the Environment, W73-11269	5B	
WOLFE, D. A.		
Cycling of Elements of Estuaries, W73-11645	5B	
WOLFE, J. E.		
Cement Mortar Lining of 20-Ft Diameter Steel Pipe, W73-11522	8F	
WONG, K. W.		
Computer Program System for Aerotriangulation, W73-11518	7C	
WONG, M. K.		
DDT, DDE, and Polychlorinated Biphenyls in Biota From the Gulf of Mexico and Caribbean Sea-1971, W73-11580	5B	
WONG, P. T. S.		
Determination of Carbohydrate in Lake Sediment by a Modified Phenol-Sulfuric Acid Method, W73-11482	5A	
WRIGHT, H. A.		
Watershed Research, W73-11534	2A	
WRIGHT, J. C.		
Limnology of Yellowtail Reservoir and the Big Horn River, W73-11331	5C	
WYCKOFF, J. B.		
Aesthetic Preference for Water Resource Projects: An Application of Q Methodology, W73-11684	6B	
WYMAN, B. D.		
The Use of Ocean Tide Records to Detect Motions Premonitory to a Tectonic Event in the Long Beach, California Area, W73-11214	7B	
XINTARAS, C.		
Prague International Lead Panel: Effects of Atmospheric Lead on Biological Systems, W73-11265	5C	
YASUDA, H.		
A Study of Vapor Phase Polymerization and Crosslinking to Prepare Reverse Osmosis Membranes, W73-11162	3A	
YEAGER, D. W.		
Trace Metal Content of Hair, I. Zinc and copper Content of Human Hair in Relation to Age and Sex, W73-11308	5A	
YEH, G-T		
Perturbation Solution of an Equation of Atmospheric Turbulent Diffusion, W73-11348	2D	
A Power Wind Law for Turbulent Transfer Computations, W73-11344	2D	
Sensitivity of the Solution for Heat Flux or Evaporation to Off-Diagonal Turbulent Diffusivities, W73-11347	2D	
A Solution for Simultaneous Turbulent Heat and Vapor Transfer between a Water Surface and the Atmosphere, W73-11349	2D	
Unified Formulation of Wall Turbulence, W73-11346	2D	
YEN, B. T.		
Design, Structural Details, and Discontinuities in Steel, W73-11524	8G	
YIN, S. C.		
National Meat-Packing Waste Management Research and Development Program, W73-11440	5D	
YORK, E. D. L.		
A Water System Designed to Attract Industry, W73-11317	5F	
YOSHIDA, Y.		
Epidemiological Study on Clondorchis sinensis Around Lake Biwa, Shiga Prefecture: I. Survey on Distribution of Parafossarulus Manchouicus, The First Intermediate Host Snail (In Japanese), W73-11654	2H	
YU, C. W.		
Simplified Computer Approach to the Ultimate Load Analysis and Design of Reinforced Concrete Frames, W73-11499	8F	
ZAFIRIOU, O. C.		
Improved Method for Characterizing Environmental Hydrocarbons by Gas Chromatography, W73-11607	5A	
ZELLI, S.		
Improved Double Detection Gas Chromatograph-Mass Spectrometer Interface for the Analysis of Complex Organic Mixtures, W73-11663	5A	
ZENG, D. R.		
Chemical and Biological Quality of Municipal Sludge, W73-11679	5E	
ZENIN, A. A.		
Preservation of Lake Baykal (Ob okhrane ozera Baykal), W73-11407	5C	
ZENZ, D. R.		
Ozonation of Microstrained Secondary Effluent, W73-11678	5D	

and the first time I have seen it. It is a small tree, about 10 feet tall, with a trunk about 6 inches in diameter. The bark is smooth and greyish-white, with some small lenticels. The leaves are opposite, simple, elliptic-lanceolate, about 4 inches long and 1 inch wide, with a pointed tip and a serrated margin. The flowers are small, white, and bell-shaped, growing in clusters at the ends of the branches. The fruit is a small, round, yellowish-orange drupe, about 1/2 inch in diameter, with a single seed.

ORGANIZATIONAL INDEX

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, BENEDICT, MD. BENEDICT ESTUARINE LAB.	
Acute Zinc Toxicity to Rainbow Trout (<i>Salmo gairdneri</i>): Confirmation of the Hypothesis that Death is Related to Tissue Hypoxia, W73-11180	5C
ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, PA. DEPT. OF LIMNOLOGY.	
The Role of Nitrogen in the Aquatic Environment, W73-11640	5C
AGENCE NATIONALE DE VALORISATION DE LA RECHERCHE, COURVEVOIE (FRANCE). (ASSIGNEE)	
De-Oiling of Polluted Waters, W73-11226	5D
AGRICULTURAL RESEARCH SERVICE, LINCOLN, NEBR. NORTH CENTRAL REGION.	
Phosphorus Losses From Four Agricultural Watersheds on Missouri Valley Loess, W73-11209	5B
AIR PRODUCTS AND CHEMICALS, INC., ALLENTOWN, PA. (ASSIGNEE)	
Activated Sludge Sewage Treatment Process and System, W73-11239	5D
Activated Sludge Process and System, W73-11240	5D
AKADEMIYA NAUK KAZAKHSKOI SSR, ALMA-ATA. INSTITUT KHMICHESKIKH NAUK.	
Distribution of Trace Elements in Bodies of Water of Kazakhstan (Raspredeleniye mikroelementov v vodoyemakh Kazakhstana), W73-11413	2K
AKADEMIYA NAUK SSSR, GELENDZHIK. INSTITUT OKEANOLOGII.	
Some Problems in the Geochemistry of Molybdenum in the Mediterranean Sea (Nekotorye voprosy geokhimii molibdena v Sredizemnom more), W73-11410	2K
AKADEMIYA NAUK SSSR, MOSCOW. GEOLOGICHESKII INSTITUT.	
Great Glaciations in the History of the Earth (Velikie oledeniya v istorii Zemli), W73-11095	2C
AKADEMIYA NAUK SSSR, MOSCOW. INSTITUT GEOKHIMII I ANALITICHESKOI KHIIMI.	
Conditions of Preservation of Chlorophyll, Pheophytin, and Humic Substances in Black Sea Sediments (Usloviya sokhrannosti khlorofilla, feofitina i guminovykh veshchestv v otlozheniyakh Chernogo morya), W73-11411	2J
AKADEMIYA NAUK SSSR, MOSCOW. INSTITUT OKEANOLOGII.	
Role of Iron Sulfides in the Accumulation of Trace Elements in Black Sea Sediments (Rol'sulfidov zheleza pri nakoplenii mikroelementov v osadkakh Chernogo morya), W73-11409	2J
AKADEMIYA NAUK SSSR, VLADIVOSTOK. INSTITUT BIOLOGII.	
Arsenic in the Lipid Extracts of Marine Invertebrates, W73-11189	5C
AKADEMIYA NAUK SSSR, YAROSLAVL. INSTITUT BIOLOGII VNUTRENNYKH VOD.	
Microbial Activity as a Biogeochemical Factor in the Ocean, W73-11378	5B
On The Age of Stable Organic Matter—Aquatic Humus in Oceanic Waters, W73-11379	5B
Tropical Role of Bacteria in the Ecosystem of the Coral Reef, W73-11632	5A
ALABAMA-TOMBIGBEE RIVERS REGIONAL PLANNING AND DEVELOPMENT COMMISSION, CAMDEN.	
Comprehensive Regional Water and Sewer Inventory and Analysis, W73-11670	7B
ALASKA UNIV., COLLEGE. INST. OF MARINE SCIENCE.	
Atomic Absorption Spectrophotometry in the Field of Marine Research, W73-11298	5A
Continuous Culture of <i>Rhodotorula rubra</i> : Kinetics of Phosphate-Arsenate Uptake, Inhibition, and Phosphate-Limited Growth, W73-11574	5A
ALASKA UNIV., COLLEGE. INST. OF WATER RESOURCES.	
Finite Element Solution for General Fluid Motion, W73-11091	8B
ALASKA UNIVERSITY, COLLEGE. INST. OF WATER RESOURCES.	
A Catalog of Hydroclimatological Data for Alaska's Coastal Zone, W73-11056	2B
ALBANY-DOUGHERTY COUNTY PLANNING COMMISSION, ALBANY, GA.	
Geonatural Resource Planning, Proposed Guidelines for a Detailed Geonatural Resource Inventory and Analysis Required to Undertake a Comprehensive Planning and Development for Albany/Dougherty County, Georgia, W73-11672	7A
ALBERTA UNIV., EDMONTON. DEPT. OF CHEMISTRY.	
Determination of Phenols and Aromatic Amines by Direct Titration with Bromine in Propylene Carbonate, W73-11485	5A
AMERICAN IRON AND STEEL INST., NEW YORK.	
Biological Removal of Carbon and Nitrogen Compounds from Coke Plant Wastes, W73-11328	5D
AMERON PIPE LINING DIV., WILMINGTON, CALIF.	
Cement Mortar Lining of 20-Ft Diameter Steel Pipe, W73-11522	8F
AMSTERDAM UNIV., (NETHERLANDS).	
CORONEL LAB. FOR OCCUPATIONAL MEDICINE AND ENVIRONMENTAL HEALTH.	
Certain Biological Effects of Lead Upon the Animal Organism, W73-11307	5C
AQUA-CHEM, INC., MILWAUKEE, WIS. (ASSIGNEE)	
Flash Evaporator Structure, W73-11358	3A
AQUATIC SCIENCES, INC., BOCA RATON, FLA.	
Environmental Effects on Toxaphene Toxicity to Selected Fishes and Crustaceans, W73-11323	5C
ARIZONA UNIV., TUCSON. DEPT. OF SOILS, WATER AND ENGINEERING.	
Steady-State Seepage in a Hillside, W73-11212	2G
ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.	
Effects of Submerged Silts in the St. Clair River, W73-11089	8B
ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS. HYDRAULICS LAB.	
Simultaneous, Multiple-Level Release from Stratified Reservoirs, W73-11567	8B
ARTESIA CHAMBER OF COMMERCE, N. MEX.	
The Biggest Artesian Well in the World, W73-11481	8A
ATOMIC ENERGY COMMISSION, OAK RIDGE, TENN.	
Nuclear Dual Purpose Plants in Regional Development, W73-11496	3A
ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL (ENGLAND).	
Trace Elements in the Atmospheric Environment, W73-11299	5A
AUBURN UNIV., ALA. DEPT. OF CIVIL ENGINEERING.	
Radial Propagation of Water Potential in Stems, W73-11181	3F
AUSTRALIAN ATOMIC ENERGY COMMISSION RESEARCH ESTABLISHMENT, LUCAS HEIGHTS.	
A Solvent Extraction Method for the Determination of Phosphorus-32 in Sea Water, W73-11643	5A
AVCO CORP., WILMINGTON, MASS. AVCO SPACE SYSTEMS DIV.	
Spray Freezing, Decanting, Melting and Hydrolysis as Related to Secondary Refrigerant Desalting, W73-11158	3A
BASF-WYANDOTTE CHEMICAL CORP., MICH. (ASSIGNEE)	
Method of Removing Oil from Water, W73-11225	5G
BATTELLE COLUMBUS LABS., OHIO.	
An Environmental Evaluation System for Water Resource Planning, W73-11151	6A
Operation of the Analytical Methodology Information Center, W73-11336	5A

ORGANIZATIONAL INDEX

BATTELLE-PACIFIC NORTHWEST LABS.,

BATTELLE-PACIFIC NORTHWEST LABS., RICHLAND, WASH.
Phosphorus Release from Lake Sediments, W73-11072

5C

BAYLOR COLL. OF MEDICINE, HOUSTON, TEX. INST. FOR LIPID RESEARCH.
Comparison of Selective Ion Monitoring and Repetitive Scanning During Gas Chromatography-Mass Spectrometry, W73-11493

5A

New Picogram Detection System Based on a Mass Spectrometer With an External Ionization Source at Atmospheric Pressure, W73-11608

5A

BECKER DRILLING LTD., CALGARY (ALBERTA).
Operation and Capability of the Becker Hammer Drill, W73-11470

8C

BEDFORD INST., DARTMOUTH (NOVA SCOTIA).
Dispersed and Particulate Petroleum Residues in the Gulf of St. Lawrence, W73-11612

5B

BELLE LABS., MURRAY HILL, N.J.
Ultrapurity in Trace Analysis, W73-11483

5A

BHABHA ATOMIC RESEARCH CENTRE, BOMBAY (INDIA).
Organic Materials in the Marine Environment and the Associated Metallic Elements, W73-11184

5B

BIOLOGICAL FEDERATION FOR SOIL AND FORESTRY, BERLIN (WEST GERMANY).
Clean-Up of Crude Extracts Containing Pesticide Residues by an Aromatic Apparatus Basing Upon the Principle of 'Sweep Co-Distillation', (Reinigung Pesticiddruckstange Enthalender Rohextrakte Mit Einer Automatisch Arbeitenden Apparatur Nach Dem Prinzip der Kombinierten Spülund Codestillation (Sweep Codistillation)), W73-11124

5A

BIONOMICS, INC., WAREHAM, MASS.
Survival and Gill Condition of Bluegill (Lepomis macrochirus) and Fathead Minnows (Pimephales promelas) Exposed to Sodium Nitrotriacetate (NTA) for 28 Days, W73-11621

5C

BIRMINGHAM UNIV. (ENGLAND).
Trace Analysis by Enzyme Inhibition and Activation, W73-11604

5A

BLOOMINGTON WATERWORKS, IND.
Improved Water at Lower Cost Produced with Coagulant Aid, W73-11666

5F

BOEING COMPUTER SERVICES, INC., SEATTLE, WASH.
Natural Resource Information System Remote Sensing Studies, W73-11571

7B

BONESTROO, ROSENE, ANDERLIK AND ASSOCIATES, INC., MANKATO, MINN.
Radial Collector Well Solves Water Supply Problem, W73-11473

8B

BOSTON UNIV., MASS. DEPT. OF ECONOMICS.
Peak Load Pricing Model of an Electric Utility Using Pumped Storage, W73-11146

6A

BOWATERS SOUTHERN PAPER CORP., CALHOUN, TENN.
A Control System for Mill Effluent Disposal, W73-11312

5G

BRIDGEWATER STATE COLL., MASS. DEPT. OF CHEMISTRY.

Durbian (Trademark) and Diazinon Residues in Biota Following Treatment of Intertidal Plots on Cape Cod - 1967-69, W73-11627

5C

BRIGHAM YOUNG UNIV., PROVO, UTAH. DEPT. OF CHEMISTRY.

Pesticides in Water, W73-11618

5B

BRISTOL UNIV. (ENGLAND). DEPT. OF GEOLOGY.

Living Foraminiferids of Tidal Marshes: A Review, W73-11502

2L

BRITISH COLUMBIA RESEARCH COUNCIL, VANCOUVER.

Identification of the Constituents of Kraft Pulping Effluent That are Toxic to Juvenile Coho Salmon (*Oncorhynchus kisutch*), W73-11638

5A

BRITISH COLUMBIA RESEARCH COUNCIL, VANCOUVER. DIV. OF APPLIED BIOLOGY.

Effects of a 12-Hr and 25-Day Exposure to Kraft Pulp Mill Effluent on the Blood and Tissues of Juvenile Coho Salmon (*Oncorhynchus kisutch*), W73-11620

5C

BRITISH COLUMBIA UNIV., VANCOUVER. DEPT. OF GEOLOGY.

Application of Regression Analysis to the Study of Background Variations in Trace Metal Content of Stream Sediments, W73-11179

5A

BRITISH COLUMBIA UNIV., VANCOUVER. INST. OF OCEANOGRAPHY.

The Seasonal Cycle of Vitamin B12 in the Strait of Georgia, British Columbia, W73-11578

2L

BROWN AND BUTLER, BATON ROUGE, LA.

Study for Improvement of Monte Sano Bayou from Airline Highway to Mississippi River East Branch Rouge Parish, Louisiana. W73-11682

8A

BROWN COUNTY REGIONAL PLANNING COMMISSION, GREEN BAY, WIS.

Brown County Sewage and Solid Waste Study - 1972.

W73-11250

5E

BUKHARSKAYA SELSKOKHOZYAISTVENNAYA OPYTNAYA STANTSIIA (USSR).

Groundwater Regime in the Zone of Influence of Pumping (Rezhim gruntovyykh vod v zone vliyaniya vertikal'nogo drenazha), W73-11094

4B

BUNDESGESUNDHEITSAMT, BERLIN (WEST GERMANY).

Organochlorine Insecticides in Surface Waters in Germany-1970 and 1971, W73-11628

5C

BUREAU OF COMMUNITY ENVIRONMENTAL MANAGEMENT, ROCKVILLE, MD.

Environmental Health Planning, W73-11244

5G

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS, CANBERRA (AUSTRALIA). BASS-BACKING GEOBIOLOGICAL LAB.

Volcanic Exhalations and Metal Enrichments at Matupi Harbor, New Britain, T.P.N.G., W73-11292

5B

BUREAU OF MINES, WASHINGTON, D.C.

North Atlantic Regional Water Resources Study : Appendix H, Minerals, W73-11107

3D

BUREAU OF RECLAMATION, DENVER, COLO.

Progress Report of Residue Studies on Organic Arsenicals used for Ditchbank Weed Control, W73-11497

4A

The Impact of Weather Modification on U.S. Planning for the Rio Colorado and Rio Grande, W73-11505

3B

Wetting Requirements to Improve Collapsing Foundation Soils, W73-11526

8D

BUREAU OF RECLAMATION, DENVER, COLO. ENGINEERING AND RESEARCH CENTER.

Hydraulic Design of Stilling Basin for Pipe or Channel Outlets, W73-11533

8B

BUREAU OF RECLAMATION, FRESNO, CALIF.

Possibility of Reducing Nitrogen in Drainage Water By On Farm-Practices, (Bio-Engineering Aspects of Agricultural Drainage, San Joaquin Valley, California), W73-11324

5B

BUREAU OF RECLAMATION, WASHINGTON, D.C.

Colorado River Water Quality Improvement Program, W73-11264

5G

Report of the United States Delegation Visit to the Soviet Union: July 24 to August 6, 1972, W73-11508

8C

CALDWELL LACE LEATHER CO., AUBURN, KY.

Secondary Waste Treatment for a Small Diversified Tannery, W73-11340

5D

CALGON CORP., PITTSBURGH, PA.

Atomic Absorption Spectrophotometry as a Tool for the Water Chemist, W73-11294

5A

CALIFORNIA STATE DEPT. OF PUBLIC HEALTH, BERKELEY. BUREAU OF SANITARY ENGINEERING.

Effect of Chlorine on Fluorescent Dyes, W73-11597

5C

ORGANIZATIONAL INDEX
COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION,

CALIFORNIA UNIV., BERKELEY. (ASSIGNEE) Accelerated Biological-Chemical Wastewater Treatment, W73-11229	5D	CENTRAL INLAND FISHERIES RESEARCH INST., MADRAS (INDIA). 'Benduvala.' A Special Gear for Catching Major Carp Labeo Fimbriatus (Bloch) in Godavari River, with Observations on 'Benduvala' Fishery at Dummagudem, W73-11405	8I	COLD REGION RESEARCH AND ENGINEERING LAB., HANOVER, N.H. Towing Icebergs to Irrigate Arid Lands-Manna or Madness, W73-11566	6F
CALIFORNIA UNIV., BERKELEY. COLL. OF ENGINEERING. A Case History of Santa Cruz Harbor, California, W73-11092	8B	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, GIF-SUR-YVETTE (FRANCE). CENTRE DES FAIBLES RADIOPAECIVITÉS. Some Aspects of the Geochemistry of Marine Aerosols, W73-11372	2K	COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N.H. Ice Forces on Vertical Piles, W73-11538	8B
CALIFORNIA UNIV., DAVIS. DEPT. OF AGRICULTURAL ECONOMICS. Programing Model for Evaluating Economic and Financial Feasibility of Irrigation Projects with Extended Development Periods, W73-11149	3F	CESKOSLOVENSKA AKADEMIE VED, PRAGUE. USTAV TEORETICKÉ A APLIKOVANÉ MECHANIKY. Behaviour of Fine Sands and Silts During the Rise of Ground-Water Level, W73-11194	2G	COLE RESEDEV CORP., FAIRLAWN, N.J. (ASSIGNEE) Apparatus for Treating Sewage, W73-11231	5D
CALIFORNIA UNIV., DAVIS. DEPT. OF WATER SCIENCE AND ENGINEERING. Simultaneous Transport of Chloride and Water During Infiltration, W73-11213	2K	CESKOSLOVENSKA AKADEMIE VED, PRAGUE. USTAV TEORETICKÉ A APLIKOVANÉ MECHANIKY. Relationships Between Volume and Pore-Water Change and Shear Stress in Granular Soils, W73-11197	2G	COLORADO SCHOOL OF MINES, GOLDEN. DEPT. OF CHEMISTRY. Determination of Trace Mercury in Soil and Rock Media, W73-11297	5A
CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB. Metabolism of Tritiated Water in the Dairy Cow, W73-11186	5B	CHALMERS UNIV. OF TECHNOLOGY, GOTEBORG (SWEDEN). Torsional Stiffness of Reinforced Concrete Members Subjected to Pure Torsion, W73-11519	8F	COLORADO SCHOOL OF MINES, GOLDEN. RESEARCH INST. Environment, W73-11183	5C
CALIFORNIA UNIV., LIVERMORE. LAWRENCE RADIATION LAB. Diurnal Variation of Aerosol Trace Element Concentrations in Livermore, California, W73-11277	5B	CHEVRON RESEARCH CO., RICHMOND, CALIF. Simulated Distillation of Narrow, High Boiling Hydrocarbon Fractions, W73-11613	5A	COLORADO STATE UNIV., FORT COLLINS. Rehabilitation of Irrigation Systems for Salinity Control, W73-11509	3F
CALIFORNIA UNIV., RIVERSIDE. DEPT. OF ECONOMICS. Progressive Taxation as a Policy for Water Quality Management, W73-11147	5G	CHICAGO DEPT. OF WATER AND SEWERS, ILL. Progress Report on Water Quality of Lake Michigan Near Chicago, W73-11581	5B	COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL ENGINEERING. Cost-Effectiveness Methodologies for Data Acquisition in Water Quality Management, W73-11150	5G
CALIFORNIA UNIV., RIVERSIDE. DEPT. OF PLANT SCIENCES. Ecological and Physiological Implications of Greenbelt Irrigation - Phase I, W73-11424	5D	CINCINNATI UNIV., OHIO. COLL. OF MEDICINE, AND CINCINNATI UNIV., OHIO. DEPT. OF ENVIRONMENTAL HEALTH. Trace Metal Content of Hair, I. Zinc and copper Content of Human Hair in Relation to Age and Sex, W73-11308	5A	COLORADO STATE UNIV., FORT COLLINS. DEPT. OF FISHERY AND WILDLIFE BIOLOGY. Effects of Chemical Variations in Aquatic Environments: Volume I, Biota and Chemistry of Piceance Creek, W73-11074	5C
CAMP, DRESSER AND MCKEE, BOSTON, MASS. Least Cost Method for Sewer Design, W73-11360	5G	CITY-COUNTY PLANNING COMMISSION, ROCKFORD, ILL. Public Utilities in Winnebago County. W73-11263	3D	COLORADO STATE UNIV., FORT COLLINS. DEPT. OF ENVIRONMENTAL HEALTH. Effects of Chemical Variations in Aquatic Environments: Volume II, Toxic effects of aqueous aluminum to rainbow trout, W73-11075	5C
CAPROCO CORROSION PREVENTION LTD., EDMONTON (ALBERTA). Four Phenomena Affecting Cathodic Protection and Corrosion Rates, W73-11475	8G	CLARKSON COLL. OF TECHNOLOGY, POTSDAM, N.Y. Flexural Fatigue Strength of Steel Fiber Reinforced Concrete Beams, W73-11498	8F	COLORADO STATE UNIV., FORT COLLINS. DEPT. OF ZOOLOGY. A Centrifuge Method for Determining Live Weights of Aquatic Insect Larvae, with a Note on Weight Loss in Preservative, W73-11647	5A
CASE WESTERN RESERVE UNIV., CLEVELAND, OHIO. SYSTEMS RESEARCH CENTER. Multilevel Control of Multipollutant System, W73-11363	5G	CLARKSON COLL. OF TECHNOLOGY, POTSDAM, N.Y. DEPT. OF CHEMICAL ENGINEERING. Dispersion and Miscible Displacement, W73-11167	3A	COLUMBIA PLYWOOD CORP., PORTLAND, OREG. Aerobic Secondary Treatment of Plywood Glue Wastes, W73-11065	5D
CATHODIC PROTECTION SERVICE, TULSA, OKLA. Design and Installation of Deep Anode Groundbeds, W73-11480	8B	CLEMSON UNIV., S.C. DEPT. OF TEXTILES. A Study of the Photodegradation of Commercial Dyes, W73-11325	5B	COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, GLEN OSMOND (AUSTRALIA). DIV. OF SOILS. Tritium Concentration of a Variety of Water Samples: Fifth Listing, W73-11104	5B
CELANESE RESEARCH CO., SUMMIT, N.J. Investigation of Polybenzimidazole Hollow Fiber Reverse Osmosis Desalination Membranes, W73-11157	3A	COAST GUARD, WASHINGTON, D.C. POLLUTION PREVENTION PROJECTS BRANCH. Crude Oil Behavior on Arctic Winter Ice, W73-11539	5B	The Environmental Tritium Concentration of Underground Water and Its Hydrological Interpretation, W73-11544	2F
CENTRAL ARID ZONE RESEARCH INST., JODHPUR (INDIA). Analysis of Soil Temperatures in the Arid Zone of India by Fourier Techniques, W73-11177	2G				

ORGANIZATIONAL INDEX

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION,

The Heavy Metal Content of Rainfall in the East Midlands, W73-11648	5A	A Solution for Simultaneous Turbulent Heat and Vapor Transfer between a Water Surface and the Atmosphere, W73-11349	2D	DEPARTMENT OF THE ENVIRONMENT, BURLINGTON (ONTARIO). CENTRE FOR INLAND WATERS.
COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, GRIFFITH (AUSTRALIA). DIV. OF IRRIGATION RESEARCH.		CORPS OF ENGINEERS, WEST PALM BEACH, FLA.		Biological Oxidation of the Hydrocarbons in Aqueous Phase, W73-11132
Response of Relative Water Content in Zea Mays L. to Changes of Potential in the Rhizosphere and Atmosphere, W73-11145	3F	Water Requirements for Optimum Crop Yield, W73-11507	3F	5B
CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN.		CORROSION ENGINEERS LTD., ALRESFORD, (ENGLAND).		Isolation of Salmonellae from Moderately Polluted Waters, W73-11134
Comparison of Simulated and Actual Evaporation From Maize and Soil in a Lysimeter, W73-11201	2D	Cathodic Protection—Theory and Practice in the Water Industry, W73-11472	8A	5A
Lead Emissions from Incinerated Sewage Sludge Detected on Tree Foliage, W73-11302	5A	CREW (ALFRED), RIDGEWOOD, N.J.		Determination of Carbohydrate in Lake Sediment by a Modified Phenol-Sulfuric Acid Method, W73-11482
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS, SANTIAGO (SPAIN).		Water Supply Improvements Feature New Coagulator, W73-11315	5F	5A
DEPARTAMENTO DE QUÍMICA ANALÍTICA.		DARTMOUTH COLL., HANOVER, N.H. DEPT. OF PHYSIOLOGY.		DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO). WATER RESOURCES BRANCH.
Volumetric Determination of Nickel by High Frequency Impedimetry, W73-11127	5A	Toxic Effects of Trace Elements on the Reproduction of Mice and Rats, W73-11190	5C	Investigation of Infrared Anomalies in the Lac Des Deux Montagnes Area, Quebec, W73-11541
CONSIGLIO NAZIONALE DELLE RICERCHE, ROME (ITALY).		DATAGRAPHICS, INC., PITTSBURGH, PA.		7B
Apparatus for Use in an Improved Electro-Dialysis Process, W73-11230	3A	Economic Feasibility of Minimum Industrial Waste Load Discharge Requirements, W73-11335	5D	Drainings of Ice-Dammed Summit Lake, British Columbia, W73-11547
CONSOLIDATED FOODS CORP., SANTA MARIA, CALIF. UNION SUGAR DIV.		DELAWARE RIVER AND BAY AUTHORITY, NEW CASTLE.		2E
2,4,6-Triphenylpyrrolium Chloride. A New Organic Analytical Reagent for the Determination of Certain Anions, W73-11623	5A	Marine Sanitation System Demonstration, W73-11059	5D	DEPARTMENT OF THE INTERIOR, WASHINGTON, D.C. (ASSIGNEE).
COPENHAGEN UNIV., HILLEROD (DENMARK). FRESHWATER BIOLOGICAL LAB.		DELAWARE UNIV., NEWARK, COLL. OF MARINE STUDIES.		Softening of Sea Water by Addition of Barium Carbonate and CO ₂ , W73-11236
A Comparison of Benthic Microalgal Production Measured by C-14 and Oxygen Methods, W73-11658	5A	Hydraulic Model Measurements of Tidal Currents Around Cape Henlopen, Delaware, W73-11203	2L	5F
CORNELL UNIV., ITHACA, N.Y. DEPT. OF ENTOMOLOGY.		DELAWARE UNIV., NEWARK. DEPT. OF BIOLOGICAL SCIENCES.		Softening of Sea Water by Addition of Barium Carbonate and Mineral Acid, W73-11237
Population Studies of three Aquatic Gastropods in an Intermittent Backwater, W73-11494	5A	Pollution Effects on Phycovirus and Host Algae Ecology, W73-11635	5C	5F
CORNELL UNIV., ITHACA, N.Y. SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING.		DELAWARE UNIV., NEWARK. DEPT. OF CHEMICAL ENGINEERING.		DESALINATION SYSTEMS, INC., ESCONDIDO, CALIF. (ASSIGNEE)
Radiation, Evaporation and the Maintenance of Turbulence under Stable Conditions in the Lower Atmosphere, W73-11343	2D	Reactor Model Parameters - Two-Phase Reactor Design Tubular Reactors, W73-11138	5F	Reverse Osmosis Water Purifying System with Gradient Barrier Water Storage Container, W73-11356
A Power Wind Law for Turbulent Transfer Computations, W73-11344	2D	DENVER BOARD OF WATER COMMISSIONERS, COLO.		3A
Computing Evapotranspiration by Geostrophic Drag Concept, W73-11345	2D	60-MGD Microstraining Plant Meets Denver's Growing Needs, W73-11667	5F	DNEPROPETROVSKI KHIKIMIKO-TEKHNOLOGICHESKII INSTITUT, (USSR).
Sensitivity of the Solution for Heat Flux or Evaporation to Off-Diagonal Turbulent Diffusivities, W73-11347	2D	DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, WASHINGTON, D.C.		Problem of the Influence of Shape of Channel Cross Section on Velocity Distribution in a Uniform Turbulent Flow (K voprosu o vliyanii formy secheniya rulsa na raspredeleniye skorostey v ravnomennom turbulentnom potokе), W73-11408
Perturbation Solution of an Equation of Atmospheric Turbulent Diffusion, W73-11348	2D	Housing and Planning References. W73-11251	3D	8B
		DEPARTMENT OF LANDS AND FORESTS, MAPLE (ONTARIO), RESEARCH BRANCH.		DRESSER INDUSTRIES, INC., HOUSTON, TEX.
		Parasites of Fish from Lake of the Woods, Ontario, W73-11172	2I	Typical Log-Curve Shapes Indicate Formation Characteristics, W73-11456
		DEPARTMENT OF NATURAL RESOURCES, QUEBEC. MINERAL RESEARCH CENTER.		8A
		Oxidation of Copper (II) Selenide by Thiobacillus Ferrooxidans, W73-11171	5C	DU PONT DE Nemours (E. I.) AND CO., AIKEN, S. C. SAVANNAH RIVER LAB.
				Multi-Element Neutron Activation Analysis of Sediment Using a Californium-252 Source, W73-11644
				5A
		DU PONT DE Nemours (E. I.) AND CO., WILMINGTON, DEL.		DU PONT DE Nemours (E. I.) AND CO., WILMINGTON, DEL.
		Auto Exhaust - Lead Vs Aromatics, W73-11301		5A
		DUNDEE UNIV. (SCOTLAND). DEPT. OF BIOLOGICAL SCIENCES.		DUNDEE UNIV. (SCOTLAND). DEPT. OF BIOLOGICAL SCIENCES.
		The Effects of Water Stress on Nitrogen-fixing Root Nodules: II. Effects of the Fine Structure of Detached Soybean Nodules, W73-11415		5F
		The Effects of Water Stress on Nitrogen-fixing Root Nodules: III. Effects of Osmotically Applied Stress, W73-11416		3F

ORGANIZATIONAL INDEX

FLORIDA UNIV., GAINESVILLE. DEPT. OF SOIL SCIENCE.

EARTH SCIENCES ASSOCIATES, PALO ALTO, CALIF. Ground Rupture in the Baldwin Hills, W73-11206	5E	ENVIRONMENTAL PROTECTION AGENCY, ATHENS, GA. SOUTHEAST ENVIRONMENTAL RESEARCH LAB. Preimpoundment Study, Carters Lake, W73-11530	6G	FISHERIES RESEARCH BOARD OF CANADA, HALIFAX (NOVA SCOTIA). HALIFAX LAB. Total Mercury and Methylmercury Content of the American Eel (<i>Anguilla rostrata</i>), W73-11576	6C
EAST BAY WATER CO., OAKLAND, CALIF. Helicopter Application of Copper Sulfate, W73-11419	5F	ENVIRONMENTAL PROTECTION AGENCY, ATHENS, GA. SOUTHEAST WATER LAB. Neutron Activation Analysis of Bottom Sediments, W73-11067	5A	FISHERIES RESEARCH BOARD OF CANADA, NANAIMO (BRITISH COLUMBIA). BIOLOGICAL STATION. Effects of Sublethal Concentrations of Sodium Pentachlorophenate on Growth Rate, Food Conversion Efficiency, and Swimming Performance in Underyearling Sockeye Salmon (<i>Oncorhynchus nerka</i>), W73-11656	5C
EAST SHROPSHIRE WATER BOARD (ENGLAND). Salinity Control on a Borehole Source in Bunter Sandstone, W73-11469	4B	A Study of Coastal Water Quality in the Vicinity of San Juan, Puerto Rico, January 13-31, 1971, W73-11388	5B	FISHERIES RESEARCH BOARD OF CANADA, ST. ANDREWS (NEW BRUNSWICK). BIOLOGICAL STATION. Response of Lobsters <i>Homarus americanus</i> to Odor Solution in The Presence of Bleached Kraft Mill Effluent, W73-11619	5C
EAST TENNESSEE STATE UNIV., JOHNSON CITY. DEPT. OF GEOLOGY. An Evaluation of the Utility of Available Remote Sensor Returns for a Study of Slope Failure Phenomena, W73-11216	7B	Anodic Stripping Voltammetry at a Tubular Mercury-Covered Graphite Electrode, W73-11484	5A	FISHERIES RESEARCH BOARD OF CANADA, ST. ANDREWS (NEW BRUNSWICK). PACIFIC ENVIRONMENT INST. Sublethal Effects of Bleached Kraft Pulp Mill Effluent on Respiration and Circulation in Sockeye Salmon (<i>Oncorhynchus nerka</i>), W73-11615	5C
EASTMAN KODAK CO., ROCHESTER, N.Y. Photographic Water Conservation and Reclamation Processes Study, W73-11403	5A	ENVIRONMENTAL PROTECTION AGENCY, GROSSE ILE, MICH. LAKE HURON BASIN OFFICE. Dithizone Procedure for Mercury Analysis, W73-11306	5A	FISHERIES RESEARCH BOARD OF CANADA, WEST VANCOUVER (BRITISH COLUMBIA). PACIFIC ENVIRONMENT INST. A Simple Microscale Vacuum Collector for the Elution of Closely Situated Spots from Thin-Layer Chromatograms, W73-11657	5A
EBASCO SERVICES INC., NEW YORK. Unified Formulation of Wall Turbulence, W73-11346	2D	ENVIRONMENTAL PROTECTION AGENCY, KANSAS CITY, MO. REGION VII. Water Quality Investigations: Souris River Basin, North Dakota, 1969, W73-11115	5B	FISHERIES RESEARCH BOARD OF CANADA, WEST VANCOUVER (BRITISH COLUMBIA). VANCOUVER LAB. Temperature Effects on Mercury Accumulation, Toxicity, and Metabolic Rate in Rainbow Trout (<i>Salmo gairdneri</i>), W73-11655	5C
ECOLOGICAL RESEARCH CORP. MIAMI, FLA. Development of a Mobile System for Cleaning Oil-Contaminated Beaches, W73-11064	5G	ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C. Wastewater Management Through Land Utilization - Muskegan County, Michigan, USA, W73-11515	5D	FISHERIES RESEARCH BOARD OF CANADA, WINNIPEG (MANITOBA). FRESHWATER INST. An Improved Ekman-Type Grab, W73-11659	5A
EDISON WATER QUALITY RESEARCH LAB., NJ. Standard Dispersant Effectiveness and Toxicity Tests, W73-11442	5A	(ASSIGNEE) Method and Apparatus for Detecting the Hardness Level of Water, W73-11227	7B	FISHERIES RESEARCH BOARD OF CANADA, WINNIPEG (MANITOBA). FRESHWATER INST. Ecological Monitoring of Two Beach Nourishment Projects in Broward County, Florida, W73-11528	2J
EGLIN WATER DEPT., ILL. H2S Removal from Water Without Air Pollution, W73-11314	5F	ETHYL CORP. RESEARCH LABS., FERNDALE, MICH. Composition of Airborne Lead Particles, W73-11188	5A	FLORIDA ATLANTIC UNIV., BOCA RATON. DEPT. OF ZOOLOGY. Industrial Waste Survey, Dade County, Florida, W73-11217	5B
EIDGENOESSISCHE ANSTALT FUER WASSERVERSORGUNG, ABWASSERREINIGUNG UND GEWAESSERSCHUTZ, ZURICH (SWITZERLAND). The Acceleration of the Hydrogeochemical Cycling of Phosphorus, W73-11385	5B	FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, CINCINNATI, OHIO. OHIO BASIN REGION. Land Spreading, A Conserving and Non-Polluting Method of Disposing of Oily Wastes, W73-11535	5E	FLORIDA POWER AND LIGHT CO., MIAMI. Control of Insulator Contamination in Substations, W73-11506	8C
EKOLOGISKA STATIONEN, MESSAURE (SWEDEN). Experiments on the Movement Behavior of Single-Cell Flowing Water Algae, (Experimente Zum Bewegungsverhalten Von Einzelligen Fleisswasseralgen), W73-11626	5C	FEDERAL WATER QUALITY ADMINISTRATION, FORT LAUDERDALE, FLA. LOWER FLORIDA ESTUARY STUDY. Industrial Waste Survey, Dade County, Florida, W73-11217	5B	FLORIDA STATE DIV. OF HEALTH, VERO BEACH. ENTOMOLOGY RESEARCH CENTER. Environmental Hazards in the Control of Disease Vectors, W73-11182	5C
ELMORE WATER WORKS, OHIO. Softening A 46-Grain Water, W73-11665	5F	FIELD DRILLING CO., SAN ANTONIO, TEX. How to Cut Drilling Costs by Reducing Non-drilling Time, W73-11460	8A	FLORIDA UNIV., GAINESVILLE. DEPT. OF ENVIRONMENTAL ENGINEERING SCIENCES. Chemical Cycles with Energy Circuit Models, W73-11381	2A
ENGINEERING SURVEYS LTD., WEYBRIDGE (ENGLAND). An Individual Approach to Independent Computer Survey, W73-11512	7C	FIELD STUDIES COUNCIL, PEMBROKE (ENGLAND). OIL POLLUTION RESEARCH UNIT. Recovery of Salt Marsh Vegetation From Successive Oil Spillages, W73-11649	5C	FLORIDA UNIV., GAINESVILLE. DEPT. OF SOIL SCIENCE. Movement of Acarol and Terbil Pesticides During Displacement Through Columns of Wabasso Fine Sand, W73-11537	5B
ENVIRONMENTAL HEALTH LAB., MCCLELLAN AFB, CALIF. Water Sampling Guidelines and Interpretation of Data, W73-11205	7A	FISCHER AND PORTER CO., WARMINSTER, PA. Filter Washing Goes Modern, W73-11448	5F		

ORGANIZATIONAL INDEX

FOREST RESEARCH INST., PRETORIA (SOUTH AFRICA).

FOREST RESEARCH INST., PRETORIA

(SOUTH AFRICA).

The Effect of Afforestation on Streamflow at Cathedral Peak: Report No. 1,
W73-11310

4C

FORT HARE UNIV. (SOUTH AFRICA).

FAKULTAET LANDROU.

Relationships between Moisture Retention and Particle Size Distribution of the Soil,
W73-11634

2G

FORT LEWIS COLL., DURANGO, COLO.

Public Participation in Urban Water Planning,
W73-11257

6B

FRESHWATER FISHERIES RESEARCH LAB., TOKYO (JAPAN).

Survival Potential of F1 Hybrids Among Salmonid Fishes,
W73-11653

8I

GENERAL ELECTRIC CO., LYNN, MASS.

Research on Reverse Osmosis Membranes for Purification of Wash Water at Sterilization Temperature (165F),
W73-11159

3A

GEOLOGICAL SURVEY, ARLINGTON, VA.

Sampling Procedures and Problems in Determining Pesticide Residues in the Hydrologic Environment,
W73-11660

5A

GEOLOGICAL SURVEY, AUSTIN, TEX.

Effects of Urbanization on Floods in the Houston, Texas, Metropolitan Area,
W73-11402

4C

GEOLOGICAL SURVEY, BISMARCK, N. DAK.

Ground-water Basic Data of Cavalier and Pembina Counties,
W73-11397

4B

GEOLOGICAL SURVEY, CARSON CITY, NEV.

Bathymetric Reconnaissance of Wild Horse Reservoir, Elko County, Nevada,
W73-11219

7C

Bathymetric Reconnaissance of Weber Reservoir, Mineral County, Nevada,
W73-11220

7C

Bathymetric Reconnaissance of Lake Tahoe, Nevada and California,
W73-11531

2H

GEOLOGICAL SURVEY, DENVER, COLO.

Precision and Detection Limits of Cadmium, Manganese, Cobalt, and Nickel in Sulfides by Electron Microprobe Analysis,
W73-11178

5A

The Use of Atomic Absorption for Analysis of Natural Waters,
W73-11291

5A

Determination of Total Chromium in Fresh Waters by Atomic Absorption,
W73-11295

5A

GEOLOGICAL SURVEY, FORT WORTH, TEX.

Annual Compilation and Analysis of Hydrologic Data for Urban Studies in the Fort Worth, Texas, Metropolitan Area, 1971,
W73-11215

4C

GEOLOGICAL SURVEY, HARRISBURG, PA.

Effects of Roadway and Pond Construction on Sediment Yield Near Harrisburg, Pennsylvania,
W73-11700

2J

GEOLOGICAL SURVEY, HARRISBURG, PA.

WATER RESOURCES DIV.

An Inventory of Suspended Sediment Stations and Type of Data Analysis for Pennsylvania Streams, 1947-70,
W73-11063

2J

GEOLOGICAL SURVEY, HARTFORD, CONN.

Water Resources Inventory of Connecticut: Part 6. Upper Housatonic River Basin,
W73-11555

2A

GEOLOGICAL SURVEY, HONOLULU, HAWAII. WATER RESOURCES DIV.

An Investigation of Floods in Hawaii Through September 30, 1972,
W73-11404

2E

GEOLOGICAL SURVEY, LAKEWOOD, COLO.

Stream Depletion Factors, Arkansas River Valley, Southeastern Colorado: A Basis for Evaluating Plans for Conjunctive Use of Ground and Surface Water,
W73-11221

4B

Water Analysis,

W73-11285

2K

GEOLOGICAL SURVEY, LANSING, MICH.

A Study of the Flint River, Michigan, as it Relates to Low-Flow Augmentation,
W73-11207

5G

GEOLOGICAL SURVEY, LINCOLN, NEBR.

Groundwater Levels in Nebraska, 1972,
W73-1120

4B

GEOLOGICAL SURVEY, LITTLE ROCK, ARK.

Fluvial Sediment in Sixmile Creek Subwatershed 6, Near Chismerville, Arkansas,
W73-11082

2J

GEOLOGICAL SURVEY, MADISON, WIS.

Ground-Water Quality in Wisconsin Through 1972,
W73-11568

2F

GEOLOGICAL SURVEY, MENLO PARK, CALIF.

Reservoir Bank Storage,
W73-11542

2H

Sand Transport by the Eel River and Its Effect on Nearby Beaches,
W73-11559

2L

GEOLOGICAL SURVEY, MENLO PARK, CALIF. WATER RESOURCES DIV.

Artificial Recharge in the Whitewater River Area, Palm Springs, California,
W73-11565

4B

GEOLOGICAL SURVEY, PORTLAND, OREG.

Groundwater Data in the Corvallis-Albany Area, Central Willamette Valley, Oregon,
W73-11093

4B

GEOLOGICAL SURVEY, RICHMOND, VA.

Virginia Small Streams Program, Preliminary Flood-Frequency Relations,
W73-11090

2E

GEOLOGICAL SURVEY, TALLAHASSEE, FLA.

Hydrologic Records for Volusia County, Florida: 1971-72,
W73-11399

7C

Applications of Multispectral Remote Sensing Techniques to Hydrobiological Investigations in Everglades National Park,
W73-11553

7B

Availability of Groundwater for Public-Water Supply in Central and Southern Escambia County, Florida: Interim Report, July 1972, W73-11563

2F

Electrical-Analog Model Study of a Hydrologic System in Southeast Florida, W73-11570

2A

GEOLOGICAL SURVEY, UNIVERSITY, ALA.

Water Resources Data for Alabama, 1970: Part 2. Water Quality Records.
W73-11085

2K

GEOLOGICAL SURVEY, WASHINGTON, D.C.

Flood of June 9-10, 1972, at Rapid City, South Dakota,
W73-11105

7C

Ground Water in Finney County, Southwestern Kansas, W73-11106

7C

Effects of Land Use and Retention Practices on Sediment Yields in the Stony Brook Basin, New Jersey, W73-11113

4C

Geology and Ground-Water Characteristics of the Hanford Reservation of the U.S. Atomic Energy Commission, Washington, W73-11204

5B

Water Resources of Hempstead, Lafayette, Little River, Miller, and Nevada Counties, Arkansas, W73-11222

4B

Lithium in Surficial Materials of the Conterminous United States and Partial Data on Cadmium, W73-11268

5B

Water Records of the U.S. Virgin Islands, 1962-69, W73-11396

2E

Hydrology and Water Resources Development in Nepal, W73-11401

4A

Radionuclides in Transport in the Columbia River from Pasco to Vancouver, Washington, W73-11549

5B

Scour and Fill in Tujunga Wash—A Fanhead Valley in Urban Southern California—1969, W73-11550

2J

Disposal of Uranium-Mill Effluent by Well Injection in the Grants Area, Valencia County, New Mexico, W73-11551

5E

Measurement of Salt-Wedge Excursion Distance in the Duwamish River Estuary, Seattle, Washington, by Means of the Dissolved-Oxygen Gradient, W73-11564

5B

GEORGIA INST., OF TECH., ATLANTA.

Theory and Practice of Public Participation in Planning,
W73-11510

6B

GEORGIA INST. OF TECH., ATLANTA.

ENGINEERING EXPERIMENT STATION.

Dyestuff Color Removal by Ionizing Radiation and Chemical Oxidation,
W73-11329

5D

ORGANIZATIONAL INDEX

GEORGIA UNIV., ATHENS.	HARVARD COLL., CAMBRIDGE, MASS.	HYDRONAUTICS, INC., LAUREL, MD.
Adsorption Characteristics of Opaline Clays From the Eocene of Georgia, W73-11536	Nitrogen and Phosphorus Uptake by Chlorella pyrenoidosa in Sewage Treatment Processes, W73-11617	Development and Preliminary Design of a Sor- bent-Oil Recovery System, W73-11071
GEORGIA UNIV., ATHENS. DEPT. OF ENTOMOLOGY.	HARVARD UNIV., CAMBRIDGE, MASS., DEPT. OF LANDSCAPE ARCHITECTURE.	The Mechanism of Formation of 'Skinned' Type Membranes and Their Characterization, W73-11153
Fluorescent Probes in the Detection of Insecti- cides in Water, W73-11061	Qualitative Values in Environmental Planning: A Study of Resource Use in Urbanizing Watersheds, W73-11253	3A
GEORGIA UNIV., ATHENS. DEPT. OF ZOLOGY.	HARZA ENGINEERING CO., CHICAGO, ILL.	HYDROTECHNIC CORP., NEW YORK.
Ecology of Yellowstone Thermal Effluent Systems: Intersects of Blue-Green Algae, Grazing Flies (Paracoenia, Ephydriidae) and Water Mites (Partuaniella, Hydrachnellae), W73-11131	Regional Waste Water, Solid Waste Disposal, Water Supply, and Storm Drainage Systems Appraisal, W73-11252	Ultra High Rate Filtration of Activated Sludge Plant Effluent, W73-11337
GEORGIA UNIV., SAPELO ISLAND. MARINE INST.	HAWAII UNIV., HONOLULU. DEPT. OF OCEANOGRAPHY.	ILLINOIS STATE NATURAL HISTORY SURVEY, URBANA.
Volume Transport, Salinity Distribution and Net Circulation in the Duplin Estuary, Georgia, W73-11425	Carbon Dioxide Dynamics: A Record of Or- ganic Carbon Production, Respiration, and Cal- cification in the Eniwetok Reef Flat Communi- ty, W73-11488	Incidence of Mercury in Illinois Pheasants, W73-11305
GHENT (BELGIUM). DEPT. OF ZOOLOGY RIJKSUNIVERSITEIT.	HAWAII UNIV., HONOLULU. WATER RESOURCES RESEARCH CENTER.	ILLINOIS STATE WATER SURVEY, PEORIA. WATER QUALITY SECTION.
Partitioning of a Brackish Water Habitat by Copepod Species, W73-11130	Direct Determination of the Electromagnetic Reflection Properties of Smooth Brackish Water to the Continuous Spectrum from 100 million to 4 billion Hertz, W73-11052	Mercury in Public Sewer Systems, W73-11585
GRACE (W. R.) AND CO., NEW YORK.	HEIDELBERG UNIV. (WEST GERMANY). SEDIMENTATION LAB.	ILLINOIS UNIV., URBANA.
Purification of Waste Water, W73-11238	Sedimentation in the Deep-Sea Areas Adjacent to the Canary and Cape Verde Islands, W73-11393	Computer Program System for Aerotriangula- tion, W73-11518
GRONINGEN RIJKSUNIVERSITEIT (NETHERLANDS). DEPT. OF MICROBIOLOGY; AND GRONINGEN RIJKSUNIVERSITEIT (NETHERLANDS). CENTRAL ELECTRONICS SERVICE.	HELSINKI UNIV. OF TECHNOLOGY, OTANIEMI (FINLAND). DEPT. OF CIVIL ENGINEERING.	ILLINOIS UNIV., URBANA. DEPT. OF AGRONOMY.
Low Cost Multichannel Scanning pH-Stat, W73-11492	Pore Pressure Measurements in Aeolotropic Peat, W73-11195	The Origin and Domestication of Sorghum Bicolor, W73-11561
GUELPH UNIV. (ONTARIO). DEPT. OF ZOOLOGY.	HINCHMAN CO., DETROIT, MICH.	ILLINOIS UNIV., URBANA. DEPT. OF CIVIL ENGINEERING.
Mercury, DDT, and PCB in Harbour Seals (Phoca vitulina) From the Bay of Fundy and Gulf of Maine, W73-11577	Cathodic Protection-The Answer to Corrosion Prevention of Underground Structures, W73-11477	Metal Toxicity to Sewage Organisms, A Discussion, W73-11266
Mercury in Harbour Porpoises (Phocoena phocoena) From the Bay of Fundy Region, W73-11588	HOPE COLL., HOLLAND, MICH. DEPT. OF CHEMISTRY.	INDIAN AGRICULTURAL RESEARCH INST., NAGPUR. ALL INDIA SOIL AND LAND USE SURVEY.
GULF OIL CORP., PITTSBURGH, PA. (ASSIGNEE)	Heavy Metals: Fallout Around a Power Plant, W73-11282	Morphology and Distribution of Soils of Lower Ib Watershed, W73-11258
Skimming Device for use on a Liquid Surface, W73-11233	HOWARD UNIV., WASHINGTON, D.C. DEPT. OF CHEMICAL ENGINEERING.	2G
GWIN, DOBSON AND FOREMAN, INC., ALTOONA, PA.	Numerical Techniques Applied to Particle Deposition During Slot Flow, W73-11697	INDIAN AGRICULTURAL RESEARCH INST., NEW DELHI. DIV. OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY.
Evaluation of Pollution Abatement Procedures Moraine State Park, W73-11062	HUNTING TECHNICAL SERVICES LTD., BOREHAM WOOD (ENGLAND).	Retention and Release of Soil Water as Related to Mineralogy of the Soil Clays, W73-11256
HADASSAH MEDICAL SCHOOL, JERUSALEM (ISRAEL).	The Classification of Arid Zone Soils: I. An Approach to the Classification of Arid Zone Soils Using Depositional Features, W73-11417	INDIAN INST. OF TECH., KHARAGPUR. DEPT. OF AGRICULTURAL ENGINEERING.
Spectrophotometric Method for Determination of Ozone in Aqueous Solutions, W73-11495	The Classification of Arid Zone Soils: II. The Classification of Sedosols in South Arabia, W73-11418	Measurement of Contact Angle of Water in Soils and Sand, W73-11273
HANS RAJ COLL. DELHI (INDIA).	HYDROMETEOROLOGICAL SERVICE OF THE USSR, MOSCOW.	INDIAN INST. OF TECH., MADRAS.
2,3-Dihydroxynaphthalene as Indicator for the Complexometric Titration of Iron (III) with EDTA, W73-11641	Preservation of Lake Baykal (Ob okhrane ozera Baykal), W73-11407	Simplified Computer Approach to the Ultimate Load Analysis and Design of Reinforced Concrete Frames, W73-11499
HARCO CORP., HAWTHORNE, CALIF.	HYDROMETEOROLOGICAL SERVICE OF THE USSR, MOSCOW.	INDUSTRIAL FILTER AND PUMP MFG. CO., CICERO, ILL.
External Corrosion of Buried Ferrous Pipelines/1, W73-11467	2G	Curtailing Pollution from Metal Finishing, W73-11283
		INSTITUT ZEMNOI KORY, IRKUTSK (USSR).
		Distribution and Composition of Mineral Water in the Tuva Autonomous Republic (Zakonomernosti rasprostraneniya i sostav pod- zemnykh mineral'nykh vod Tuvy), W73-11412

ORGANIZATIONAL INDEX

INSTITUTE OF INDUSTRIAL HYGIENE AND OCCUPATIONAL DISEASES,

INSTITUTE OF INDUSTRIAL HYGIENE AND OCCUPATIONAL DISEASES, PRAGUE (CZECHOSLOVAKIA).

Prague International Lead Panel: Effects of Atmospheric Lead on Biological Systems,
W73-11265 5C

INSTITUTE OF MEDICINE (I), RANGOON (BURMA). DEPT. OF MICROBIOLOGY.

The Bacteriology of the Water Supplies of Rangoon II. Cool Dry and Hot Dry Seasons,
W73-11630 5C

INSTITUTE OF OCCUPATIONAL AND RADIOLOGICAL HEALTH, BELGRADE (YUGOSLAVIA).

Environmental Contamination by Lead from a Mine and Smelter,
W73-11267 5C

Biochemical Tests for the Appraisal of Exposure to Lead,
W73-11309 5C

INSTITUTION OF WATER ENGINEERS, LONDON (ENGLAND).

Observation Boreholes—Construction and Use:
Final Report of Research Panel, No. 9.
W73-11466 8A

Efficiency of Well Screens and Gravel Packs:
Final Report of Research Panel, No. 6.
W73-11474 8D

IONICS, INC., WATERTOWN, MASS.

Research on Piezodialysis, Third Report,
W73-11154 3A

JADAVPUR UNIV., CALCUTTA (INDIA). DEPT. OF CIVIL ENGINEERING.

A Colorimetric Technique Suggested for Chemical Oxygen Demand Determination,
W73-11599 5A

JBF SCIENTIFIC CORP., BURLINGTON, MASS.

The Development and Demonstration of an Underwater Oil Harvesting Technique,
W73-11063 5G

JOHN HOPKINS UNIV., BALTIMORE, MD.

DEPT. OF EARTH AND PLANETARY SCIENCES.

Phosphate in Interstitial Waters of Anoxic Sediments: Oxidation Effects During Sampling Procedure,
W73-11118 5B

KANAZAWA UNIV. (JAPAN). DEPT. OF ENGINEERING.

Coefficient of Permeability of Highly Plastic Clays,
W73-11199 2G

KANSAS STATE UNIV., MANHATTAN. DEPT. OF CHEMICAL ENGINEERING.

Nonlinear Parameter Estimation in Water Quality Modeling,
W73-11361 5B

Supplementation of Missing Values in Water Quality Data,
W73-11687 5G

KANSAS UNIV., LAWRENCE.

Designing to Prevent Brittle Fractures in Bridges,
W73-11525 8G

KANSAS WATER RESOURCES RESEARCH INST., MANHATTAN.

Ground Water Recharge Through Pits and Wells,
W73-11053 4B

KENTUCKY UNIV., LEXINGTON. DEPT. OF AGRONOMY.

Capillary-Diffusion and Self-Diffusion of Liquid Water in Unsaturated Soils,
W73-11390 2G

KENTUCKY UNIV., LEXINGTON. DEPT. OF CHEMICAL ENGINEERING.

Generic Feed Forward Control of Activated Sludge,
W73-11362 5D

KENTUCKY UNIV., LEXINGTON. DEPT. OF CIVIL ENGINEERING.

Location and Determination of Depths of Subsurface Undulations by Seismic Methods,
W73-11398 8E

KENTUCKY UNIV., LEXINGTON. DEPT. OF GEOLOGY.

Calcite Saturation in an Eastern Kentucky Karst Stream,
W73-11391 2K

KERNFORSCHUNGSZENTRUM, KARLSRUHE (WEST GERMANY). INSTITUT FUER RADIOCHEMIE.

Determination of Mercury Contents in Diverse Samples of Fish and Other Biological Materials by Neutron Activation Analysis, (Neutronenaktivierungsanalytische Bestimmungen von Quecksilbergehalten in Diversen Fischproben und anderen Biologischen Materialien),
W73-11123 5A

KING'S COLL., LONDON (ENGLAND).

Internal Cracking in Reinforced Concrete Members,
W73-11523 8F

KYOTO PREFECTURAL UNIV. OF MEDICINE (JAPAN).

Epidemiological Study on *Clondorchis sinensis* Around Lake Biwa, Shiga Prefecture: I. Survey on Distribution of *Parafossarulus manchouicus*, The First Intermediate Host Snail (In Japanese),
W73-11654 2H

KYOTO UNIV. (JAPAN). DEPT. OF AGRICULTURAL RESEARCH.

Construction of a Purification Plant for Polluted Water Using Photosynthetic Bacteria,
W73-11569 5D

LABORATOIRE CENTRAL DES PONTS ET CHAUSSEES, PARIS (FRANCE).

Expansion of Cylindrical Probes in Cohesive Soils,
W73-11520 8D

LAKEHEAD UNIV., THUNDER BAY (ONTARIO). DEPT. OF PHYSICS.

Fallout of Sodium Sulphate near a Kraft Mill,
W73-11175 5A

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, N.Y.

Seismic Seiches in Bays, Channels, and Estuaries,
W73-11532 2H

LEHIGH UNIV., BETHLEHEM, PA.

A Probabilistic Approach to Maximum Column Strength,
W73-11516 8A

Design, Structural Details, and Discontinuities in Steel,
W73-11524 8G

LITTLE (ARTHUR D.), INC., CAMBRIDGE, MASS.

Assessing the Water Pollution Potential of Manufactured Products,
W73-11334 5B

LIVERPOOL UNIV. (ENGLAND). DEPT. OF OCEANOGRAPHY.

Distribution of Dissolved Mercury in the Irish Sea,
W73-11293 5B

Geological, Geochemical and Environmental Implications of the Marine Dust Veil,
W73-11383 5B

LIVERPOOL UNIV. (ENGLAND). DEPT. OF ZOOLOGY.

The Food of Brown Trout in Llyn Alaw, Anglesey, North Wales,
W73-11354 2I

LOS ANGELES BUREAU OF SANITATION, CALIF.

Characterization of the Activated Sludge Process,
W73-11069 5D

LOUISBURG COLL., N.C.

Parasite Copepods of Some Freshwater Fishes from North Carolina,
W73-11143 2I

LOUISVILLE UNIV., KY. DEPT. OF BIOLOGY.

The Freshwater Stream, A Complex Ecosystem,
W73-11389 6G

LOUVAIN UNIV. (BELGIUM). INSTITUT CARNOY.

Study of the Changes in the Structure of Two Algal Populations: An R-Type Factor Analysis,
W73-11129 5A

LUND UNIV. (SWEDEN). LIMNOLOGY INST.

Planktonic Changes Following the Restoration of Lake Trumen, Sweden,
W73-11639 5G

MAINE UNIV., ORONO. DEPT. OF ZOOLOGY.

Macrobenthic Ecology of a Sawdust-Bearing Substrate in the Penobscot River Estuary (Maine),
W73-11602 5C

MANCHESTER UNIV. (ENGLAND). DEPT. OF BOTANY.

Lead Pollution from a Factory Manufacturing Anti-Knock Compounds,
W73-11290 5B

MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM, PLYMOUTH (ENGLAND). LAB.

The Occurrence and Seasonal Variation of Trace Metals in the Scallops *Pecten maximus* (L.) and *Chlamys opercularis* (L.),
W73-11624 5A

MARINE LAB., ABERDEEN (SCOTLAND). FACTORS CONTROLLING MARINE ECOSYSTEMS,

W73-11380 5C

ORGANIZATIONAL INDEX

MOSCOW STATE UNIV. (USSR). CHAIR OF GEMORPHOLOGY.

MARYLAND UNIV., SOLOMONS. NATURAL RESOURCES INST.		
Sublethal Effects of Baltimore Harbor Water on the White Perch, <i>Morone americana</i> , and the Hogchoker, <i>Trinectes maculatus</i> , W73-11652	5C	
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.		
Design Factors for Effective Settling of Coagulated Water, W73-11451	5F	
MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF CIVIL ENGINEERING.		
Disaggregation Processes in Stochastic Hydrology, W73-11141	2E	
MASSACHUSETTS INST. OF TECH., CAMBRIDGE, MASS.		
Ion Transport Through Layered Ion Exchange Membranes, W73-11160	3A	
Membrane Fouling in Electrodialysis: A Model and Experiments, W73-11163	3A	
MASSACHUSETTS UNIV., AMHERST. DEPT. OF AGRICULTURAL AND FOOD ECONOMICS.		
Aesthetic Preference for Water Resource Projects: An Application of Q Methodology, W73-11684	6B	
MAX-PLANCK-INSTITUT FUER CHEMIE, MAINZ (WEST GERMANY).		
Nitrous Oxide in Air and Sea Water over the Atlantic Ocean, W73-11370	5B	
MCDONNELL AIRCRAFT CO., ST. LOUIS, MO. RECONNAISSANCE LAB.		
Aerial Surveillance Spill Prevention System, W73-11326	5B	
MCGILL UNIV., MONTREAL (QUEBEC).		
Numerical Statistics in Engineering Geology, W73-11517	8G	
MEDICAL RESEARCH COUNCIL, LONDON (ENGLAND). SOCIAL MEDICINE UNIT.		
Infant Mortality and Hardness of Local Water Supplies, W73-11144	5C	
MEDICAL UNIV. OF SOUTH CAROLINA, CHARLESTON. DEPT. OF BIOMETRY.		
Discrete Gradient Optimization of Water Systems, W73-11365	8B	
METROPOLITAN CORP. OF GREATER WINNIPEG (MANITOBA). WATER WORKS AND WASTE DISPOSAL DIV.		
Ozone for Supplementary Water Treatment, W73-11677	5F	
METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, ILL.		
Ozonation of Microstrained Secondary Effluent, W73-11678	5D	
Chemical and Biological Quality of Municipal Sludge, W73-11679	5E	
Leachate Quality from Acidic Mine Spoil Fertilized with Liquid Digested Sewage Sludge, W73-11680	5G	
Construction Difficulty Index for Tunnel Construction,		
W73-11681	8H	
METROPOLITAN SEWER BOARD ST. PAUL, MINN.		
MSB Computerized Combined Sewer Control System, W73-11673	5G	
MEYER INDUSTRIES, INC., RED WING, MINN.		
All-Position Production Welding with Flux-Cored Gas-Shielded Electrodes, W73-11501	8C	
MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF BOTANY.		
Plant Communities of Wet Ground in Northeast Cheshire, England, W73-11552	2L	
MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF GEOLOGY.		
A Principles Study of Factors Affecting the Hydrological Balance of the Lemon Glacier System and Adjacent Sectors of the Juneau Icefield, Southeastern Alaska, 1965-1969, W73-11054	2C	
MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF METEOROLOGY AND OCEANOGRAPHY.		
Areawide Trace Metal Concentrations Measured by Multielement Neutron Activation Analysis - A One Day Study in Northwest Indiana, W73-11278	5B	
MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF MICROBIOLOGY.		
Investigations into the Occurrence of Coliform Organisms from Pristine Streams, W73-11428	5B	
MICHIGAN STATE UNIV., HICKORY CORNERS. W.K. KELLOGG BIOLOGICAL STATION.		
Leaf Processing in a Woodland Trout Stream, W73-11112	5B	
MICHIGAN UNIV., ANN ARBOR. DEPT. OF CIVIL ENGINEERING.		
Water Quality Models for Total Coliform, W73-11135	5B	
A Dynamic programming approach for Investment Strategies in Wastewater Treatment Plants, W73-11426	5D	
MICHIGAN UNIV., ANN ARBOR. DEPT. OF MECHANICAL ENGINEERING.		
A Model for Rain Erosion of Homogeneous Materials, W73-11560	8G	
MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.		
Spring Phytoplankton Abundance and Productivity in Grand Traverse Bay, Lake Michigan, 1970, W73-11629	5B	
MICHIGAN UNIV., ANN ARBOR. MUSEUM OF ZOOLOGY.		
The Effects of Temperature on Growth and Reproduction of Aquatic Snails, W73-11444	5C	
MICHIGAN UNIV., ANN ARBOR. SCHOOL OF NATURAL RESOURCES.		
The Evolving Role of the Federal Government in the Management of Lake Michigan, W73-11247	6E	
MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, (ENGLAND). FISHERIES LAB.		
A Continuous-Flow Apparatus for Assessing the Toxicity of Substances to Marine Animals, W73-11169	5C	
MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, LOWESTOFT (ENGLAND). FISHERIES RADIobiological LAB.		
The Accumulation from Water of ZN-65, MN-54, CO-58, and FE-59 by the Mussel, <i>Mytilus edulis</i> , W73-11625	5A	
MINISTRY OF THE ENVIRONMENT, OTTAWA (ONTARIO). WATER MANAGEMENT.		
Lead Contamination of Snow, W73-11275	5B	
MINNESOTA UNIV., ST. PAUL. DEPT. OF AGRICULTURAL AND APPLIED ECONOMICS.		
An Economic Analysis of Flood Damage Reduction Alternatives in the Minnesota River Basin, W73-11055	6F	
MISSISSIPPI STATE UNIV., STATE COLLEGE. DEPT. OF SANITARY ENGINEERING.		
Taste and Odor Control in Water, W73-11318	5F	
MISSOURI UNIV., COLUMBIA. DEPT. OF CHEMISTRY.		
Copper Determination in Water by Standard Addition Potentiometry, W73-11605	5A	
MISSOURI UNIV., ROLLA. DEPT. OF CIVIL ENGINEERING; AND MISSOURI UNIV., ROLLA. ENVIRONMENTAL HEALTH RESEARCH CENTER.		
The Lead Industry as a Source of Trace Metals in the Environment, W73-11269	5B	
An Investigation of Environmental Pollution by Lead and Other Heavy Metals from Industrial Development in Southeastern Missouri, W73-11270	5B	
Environmental Impact of Trace Metals on the New Lead Belt of S.E. Missouri, W73-11271	5C	
MONTANA STATE UNIV., BOZEMAN.		
Limnology of Yellowtail Reservoir and the Big Horn River, W73-11331	5C	
MONTANA STATE UNIV., BOZEMAN. WATER RESOURCES RESEARCH CENTER.		
The Response of Native Montana Grasses to Soil Water Stress, W73-11429	21	
MOSCOW STATE UNIV. (USSR). CHAIR OF GEMORPHOLOGY.		
Principles of Landslide Identification from Aerial Survey Data (Printsy raspoznavaniya opolznevnykh protsessov po materialam aeroftos'yemki), W73-11100	23	

ORGANIZATIONAL INDEX

MOSCOW STATE UNIV. (USSR). CHAIR OF HYDROLOGY.

Inflow to Rivers in the Pamirs (Pitaniye rek Pamira),
W73-11096 2C

Minimum Flow in the Iberian Peninsula (Minimal'nyy stok rek Pireneyskogo polusotrova),
W73-11098 2E

Distribution of Average Turbidity of Rivers in the Armenian SSR (Raspredeleniye sredney mutnosti rek po territorii Armyanskoy SSR),
W73-11099 2E

Investigation of Seasonal Variability of Runoff on Rivers in the Altay and Sayan Mountain Systems (Issledovaniye vnutrigodovoy neravnomernosti stoka rek Altaya i Sayan),
W73-11101 2E

MOSCOW STATE UNIV. (USSR). KAFEDRA FIZICHESKOI GEOGRAFII.
Karst Landscapes and Karst Forms (Karstovyye landshafty i tipy karsta),
W73-11102 4A

MOSCOW STATE UNIV. (USSR). KAFEDRA OBRSHCHEI FIZICHESKOI GEOGRAFII PALEOGEOGRAFII.

Rate of Retreat of Yuzhno-Chuya Glaciers in the Gorno-Altay Autonomous Oblast (O skorosti otstupaniya lednikov Yuzhno-Chuyskih belkov Gornogo Altaya),
W73-11097 2C

MSA RESEARCH CORP., EVANS CITY, PA.
Control of Hazardous Chemical Spills by Physical Barriers,
W73-11338 5G

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, CLEVELAND, OHIO. LEWIS RESEARCH CENTER.

Survey of Application of Radiation to Preparative Chemistry,
W73-11119 2K

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, HOUSTON, TEX. MANNED SPACECRAFT CENTER.
Apollo Experience Report, Potable Water System,
W73-11202 5F

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, HUNTSVILLE, ALA. GEORGE C. MARSHALL SPACE FLIGHT CENTER.

Unsupervised Spatial Clustering with Spectral Discrimination,
W73-11116 7C

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, LANGLEY STATION, VA. LANGLEY RESEARCH CENTER.

The Inference of Atmospheric Ozone Using Satellite Nadir Measurements in the 1042/CM Band,
W73-11400 7B

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D.C.
Remote Sensing Techniques for Detecting Oil Slicks,
W73-11137 5A

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, HOUSTON, TEX.

A Literature Survey--Performance of Exceptional Metals in Corrosive Environments,
W73-11479 8G

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D.C.

Highly Resistant Copper Deteriorates in Severely Corrosive Soils,
W73-11454 8G

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D.C. ANALYTICAL CHEMISTRY DIV.

Interaction of Nitrilotriacetic Acid with Suspended and Bottom Material,
W73-11339 5A

NATIONAL CANNERS ASSOCIATION RESEARCH FOUNDATION, CALIF.

Low Water Volume Enzyme Deactivation of Vegetables Before Preservation,
W73-11330 5D

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH, BOULDER, COLO.

Climate Change and the Influence of Man's Activities on the Global Environment,
W73-11562 2A

NATIONAL FIELD INVESTIGATIONS CENTER-DENVER, COLO.

Report on Evaluations of Waste Sources in the Calcasieu River Basin, Louisiana.
W73-11529 5B

NATIONAL MARINE FISHERIES SERVICE, BEAUFORT, N.C. ATLANTIC ESTUARINE FISHERIES CENTER.

Cycling of Elements of Estuaries,
W73-11645 5B

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WASH. NORTHWEST FISHERIES CENTER.

Physical-Chemical Oceanographic Data from the North Pacific Ocean and Bering Sea, 1971,
W73-11595 5A

NATIONAL MARINE WATER QUALITY LAB., WEST KINGSTON, R.I.

Copper Induced Lesions in Estuarine Teleosts,
W73-11616 5C

Influence of Lead and Other Metals on Fish Delta-Aminolevulinic Dehydrase Activity,
W73-11646 5A

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, BOULDER, COLO. WAVE PROPAGATION LAB.

Applications of Remote Sensing Techniques to Buoy-Based Environmental Data Gathering,
W73-11631 5A

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SILVER SPRING, MD. AIR RESOURCES LABS.

The Role of the Oceans and Biosphere in the Carbon Dioxide Cycle,
W73-11373 2K

NATIONAL TAIWAN UNIV., TAIPEI. DEPT. OF PARASITOLOGY.

Studies on Schistosomiasis in Mekong Basin:
II. Malacological Investigations on Human Schistosoma from Laos,
W73-11633 5C

NATIONAL WATER AND SOIL CONSERVATION ORGANIZATION, WELLINGTON (NEW ZEALAND).

Urban Hydrology for the Period Up to December 1971.
W73-11698 4C

NATIONAL WATER COMMISSION, ARLINGTON, VA.

Research and Development in Water Resources, Water Resources Research, Its Role in the Total R and D Spectrum,
W73-11341 6B

NATIONAL WATER QUALITY LAB., DULUTH, MINN.

Acute and Long-Term Accumulation of Copper by the Brown Bullhead, Ictalurus Nebulosus,
W73-11593 5C

A Cyprinodont Fish, Jordanella Floridae, as a Laboratory Animal for Rapid Chronic Bioassays,
W73-11598 5C

NATIONAL WEATHER SERVICE, RENO, NEV. WEATHER SERVICE OFFICE.

Freeze-Free (32 F) Seasons of the Major Basins and Plateaus of Nevada,
W73-11218 7C

NATIONAL WEATHER SERVICE, SILVER SPRING, MD. EXTENDED FORECAST DIV.

Large-Scale and Long-Term Fluctuations in some Atmospheric and Oceanic Variables,
W73-11369 2B

NAVAL CIVIL ENGINEERING LAB., PORT HUENEME, CALIF.

Procedure Improved for Determining Corrosion Rate by Weight Loss,
W73-11478 8G

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.

Spectra of Turbulent Fluctuations Over Ocean Waves,
W73-11087 2B

The Use of Ocean Tide Records to Detect Motions Premonitory to a Tectonic Event in the Long Beach, California Area,
W73-11214 7B

Sand Movement Along Carmel River State Beach, Carmel, California,
W73-11557 2L

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF. DEPT. OF OCEANOGRAPHY.

Onshore-Offshore Sand Transport on Del Monte Beach, California,
W73-11086 2J

NAVAL RESEARCH LAB., WASHINGTON, D.C. OCEAN SCIENCE DIV.

Impact of Natural and Man-Made Surface Films on the Properties of the Air-Sea Interface,
W73-11371 5B

NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER, BETHESDA, MD.

The Thermal Conductivity of Pure Water and Standard Sea Water as a Function of Pressure and Temperature: Part II--Pure Water,
W73-11084 2K

ORGANIZATIONAL INDEX

OHIO STATE UNIV., COLUMBUS. DEPT. OF AGRONOMY.

NAVAL STATION, CANAL ZONE. FUEL DIV.				
Corrosion of Metals in Tropical Environments-Copper and Wrought Copper Alloys, W73-11455	8G			
NAVAL WEAPONS CENTER, CHINA LAKE, CALIF. MICHELSON LABS.				
High-Temperature Contact Nucleation of Supercooled Water by Organic Chemicals and Appendix of Compounds Tested, W73-11699	3B			
NEBRASKA UNIV., LINCOLN.				
Water Infiltration Under Center-Pivot Sprinklers, W73-11514	8B			
NEBRASKA UNIV., LINCOLN. DEPT. OF AGRONOMY.				
Influence of Agricultural Practices on Water Quality in Nebraska: A Survey of Streams, Groundwater, and Precipitation, W73-11696	5B			
NEVADA UNIV., RENO. DESERT RESEARCH INST.				
Hydrology of Truckee Meadows, Nevada, W73-11430	4B			
NEW HAMPSHIRE UNIV., DURHAM. INST. OF NATURAL AND ENVIRONMENTAL RESOURCES.				
Linear Programming use for Evaluating Water Resources and Cost and Benefit Allocation, W73-11683	6A			
NEW HAMPSHIRE UNIV., DURHAM. JACKSON ESTUARINE LAB.				
The Use of Modern Chromium Accumulations to Determine Estuarine Sedimentation Rates, W73-11392	2L			
NEW MEXICO STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRONOMY.				
Short-Term Effects of Irrigation with High Sodium Waters, W73-11111	3C			
NEW MEXICO UNIV., ALBUQUERQUE. DEPT. OF BIOLOGY.				
Effects of Logging on Periphyton in Coastal Streams of Oregon, W73-11582	5C			
NEW SOUTH WALES UNIV., KENSINGTON (AUSTRALIA). SCHOOL OF ECONOMICS.				
Stochastic Reservoir Management and System Design for Irrigation, W73-11152	3F			
NEW YORK CITY FIRE DEPT.				
Using Fire Streams With a Self-Propelled Oil Spill Skimmer, W73-11434	5G			
Use of Fire Streams to Control Floating Oil, W73-11435	5G			
A Small Vacuum Oil Skimming System, W73-11436	5G			
Shore Termination for Oil Spill Booms, W73-11437	5G			
Removal of Oil From Under Piers, W73-11438	5G			
A Rapidly Deployable Oil Containment Boom for Emergency Harbor Use, W73-11439	5G			
NEW YORK CITY-RAND INST., N.Y.				
A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Vol. V, Jamaica Bay Rainstorms, W73-11351	5B			
NEW YORK STATE DEPT. OF ENVIRONMENTAL CONSERVATION, ALCBANY. BUREAU OF WATER RESOURCES PLANNING.				
River Systems Transition Function and Operation Study, W73-11364	4A			
NEW YORK STATE DEPT. OF ENVIRONMENTAL CONSERVATION, ALCBANY. RESEARCH AND DEVELOPMENT UNIT.				
Phosphorus in Waste Water, W73-11592	5D			
NEW YORK STATE TEMPORARY COMMISSION ON THE WATER SUPPLY NEEDS OF SOUTHEASTERN NEW YORK, ALCBANY.				
Scope of Public Water Supply Needs, W73-11245	6D			
Emerging Water Supply Technology, W73-11246	3D			
NIKEX, BUDAPEST (HUNGARY). (ASSIGNEE)				
Process for the Removal of Cyanide from Sewage by Means of Formaldehyde, W73-11224	5D			
NOLTE (GEORGE S.) AND ASSOCIATES, SAN JOSE, CALIF.; AND SAN DIEGO COUNTY COMPREHENSIVE PLANNING ORGANIZATION, CALIF.				
Urbanization's Drainage Consequence, W73-11254	4C			
NORCON INSTRUMENTS, INC., SOUTH NORWALK, CONN.				
Gas Chromatograph Peaks Identified On-Line by a New Grating Infrared Spectrophotometer, W73-11609	5A			
NORGES TEKNISKE HOEGSKOLE, TRONDHEIM. DEPT. OF PHYSICS.				
Lead Accumulation Within Nuclei of Moss Leaf Cells, W73-11276	5E			
NORTH CAROLINA STATE UNIV., RALEIGH. DEPT. OF ENTOMOLOGY.				
The Effects of Ditching on the Mosquito Populations in Some Sections of Juncus Salt Marsh in Carteret County, North Carolina, W73-11431	4A			
NORTH CAROLINA UNIV., CHAPEL HILL.				
Application of the Fluorescent Antibody Technique to the Differentiation of Aspergillus Species, Candida Species and Zygomycetes in Paraffin Section of Formalin-Fixed Tissues, W73-11126	5A			
NORTHERN ILLINOIS UNIV., DE KALB. DEPT. OF GEOGRAPHY.				
Analysis of Lake Erie Wave Pressure Data, W73-11548	8B			
NORTHERN MAINE REGIONAL PLANNING COMMISSION, PRESQUE ISLE.				
The Northern Maine Regional Treatment System, W73-11079	5D			
NORTON CO., TROY, N.Y. (ASSIGNEE)				
Water Purification With Porous Abrasives, W73-11228	5D			
NUS CORP., PITTSBURGH, PA. CYRUS WM. RICE DIV.				
Oxidation of Pyrites in Chlorinated Solvents, W73-11068	5D			
OAK RIDGE NATIONAL LAB., TENN.				
Tube Identifier, W73-11155	3A			
Determination of Nitrogen, Sulfur, Phosphorus, and Carbon in Solid Biological Materials via Hydrogenation and Element Selective Detection, W73-11606	5A			
Liquid-Liquid Extraction of Cadmium With High-Molecular-Weight Amines From Iodide Solutions, W73-11664	5A			
OAK RIDGE NATIONAL LAB., TENN. ENVIRONMENTAL INFORMATION SYSTEMS OFFICE.				
Environmental Terminology Index, W73-11387	10C			
OBIIHO ZOOTECHNICAL UNIV. (JAPAN). DEPT. OF VETERINARY AND PUBLIC HEALTH.				
Studies on the Sources of Pollution in Dairy Water: I. Properties of the Waste Water From Potato Starch Factories (In Japanese), W73-11284	5B			
O'BRIEN (KEN) AND ASSOCIATES, ALBUQUERQUE, N. MEX.				
City of Albuquerque Sandia Foothills Drainage, W73-11668	4A			
Supplement to City of Albuquerque Sandia Foothills Drainage Study, W73-11669	4A			
OFFICE DE LA RECHERCHE SCIENTIFIQUE ET TECHNIQUE OUTRE-MER, ABIDJAN (IVORY COAST). CENTRE DE RECHERCHES OCEANOGRAPHIQUES.				
Study of the Respiration and the Nitrogen and Phosphorus Excretion of Zooplanktonic Populations of the Mauritanian Upwelling, (March-April 1972). (Etude de la Respiration et de l'Excretion d'Azote et de Phosphore des Populations Zooplanctoniques de L'Upwelling Mauritanien (Mars-Avril 1972)), W73-11603	5B			
OFFICE OF WATER RESOURCES RESEARCH, WASHINGTON, D.C.				
Phosphorus Removal, A Bibliography, Volume I, W73-11319	5D			
Phosphorus Removal, A Bibliography, Volume 2, W73-11320	5D			
Artificial Recharge of Groundwater, A Bibliography, W73-11321	4B			
OHIO STATE UNIV., COLUMBUS. DEPT. OF AGRONOMY.				
Effect of Soil, Cover, Slope, and Rainfall Factors on Soil and Phosphorus Movement Under Simulated Rainfall Conditions, W73-11208	5B			

ORGANIZATIONAL INDEX

ONTARIO WATER RESOURCES COMMISSION, TORONTO.

ONTARIO WATER RESOURCES COMMISSION, TORONTO.	PITTSBURGH UNIV., PA.	RIJKSINSTITUUT VOOR DE VOLKSGEZONDHEID, BILTHOVEN (NETHERLANDS). LAB. FOR ZOONOSES.
Systems Approach to Training and Licensing of Water Works Personnel in Ontario, W73-11676	Salt and Nonelectrolyte Interactions in Water, W73-11166	Occurrence of Salmonella in Oxidation Ditches, W73-11136
OREGON STATE UNIV., CORVALLIS. DEPT. OF CIVIL ENGINEERING.	POLLUTANT SEPARATION, INC., ELMWOOD, CONN. (ASSIGNEE)	ROBERT A. TAFT SANITARY ENGINEERING CENTER, CINCINNATI, OHIO.
Computer Simulation of Eutrophication, W73-11051	Apparatus for Separating Pollutants and Ob- taining Separate Liquids and Solids, W73-11359	Evaluation of New Algaecides for Water Supply Purposes, W73-11353
OREGON STATE UNIV., CORVALLIS. DEPT. OF FISHERIES AND WILDLIFE.	POLYENGINEERING, MOBILE, ALA.	ROBERT A. TAFT WATER RESEARCH CENTER, CINCINNATI, OHIO.
Impairment of the Flavor of Fish by Water Pol- lutants, W73-11322	Comprehensive Water Sewer Plan for Baldwin County, Alabama. W73-11261	The Case Against Mercury, W73-11303
Development of Dissolved Oxygen Criteria for Freshwater Fish, W73-11327	Comprehensive Water and Sewer Plan for Escambia County, Alabama. W73-11262	ROBERT S. KERR ENVIRONMENTAL RESEARCH LAB., ADA, OKLA.
Effects of Logging on Growth of Juvenile Coho Salmon, W73-11433	POLYMER CORP. LTD., SARNIA (ONTARIO). (ASSIGNEE)	National Meat-Packing Waste Management Research and Development Program, W73-11440
OREGON STATE UNIV., CORVALLIS. DEPT. OF MECHANICAL AND NUCLEAR ENGINEERING.	Sludge Concentration, W73-11357	ROBERT S. KERR WATER RESEARCH CENTER, ADA, OKLA.
Numerical Thermal Plume Model for Vertical Outfalls in Shallow Water, W73-11333	PRO-TECH, INC., MALVERN, PA. (ASSIGNEE).	Prediction Modeling for Salinity Control in Irr- igation Return Flows, W73-11441
OREGON STATE UNIV., CORVALLIS. DEPT. OF OCEANOGRAPHY.	Liquid Sampling, W73-11235	ROBERT S. KERR WATER RESEARCH CENTER, ADA, OKLA.
The Chemical Stability of the Oceans and the CO ₂ System, W73-11374	PURDUE UNIV., LAFAYETTE, IND. WATER RESOURCES RESEARCH CENTER.	Solvent Extraction Status Report, W73-11066
OREGON WATER DEPT., OHIO.	Iterative Simulation Algorithm in Reservoir Systems Operation, W73-11139	ROCHESTER UNIV. MEDICAL CENTER, N.Y.
A Water System Designed to Attract Industry, W73-11317	Hydraulics of Shallow Flows Over Stable Eroded Sand Surfaces Defined by Area Spec- tra, W73-11192	Transfer of Metallic Mercury into the Foetus, W73-11274
PACIFIC NORTHWEST ENVIRONMENTAL RESEARCH LAB., CORVALLIS, OREG.	QUEEN'S UNIV., KINGSTON (ONTARIO).	ROCKETDYNE, CANOGA PARK, CALIF.
Cannery Wastewater Treatment with Rotating Biological Contactor and Extended Aeration, W73-11058	DEPT. OF BIOLOGY.	Pyrographic Gross Characterization of Water Contaminants, W73-11446
PACIFIC SMELTING CO., TORRANCE, CALIF.	A Quantitative, Semiroutine Method for Deter- mining Algal and Sedimentary Chlorophyll Derivatives, W73-11637	ROME UNIV. (ITALY). ISTITUTO DI CHIMICA ANALITICA.
Recover Zinc From Zinc Ash, W73-11281	RESEARCH TRIANGLE INST., DURHAM, N.C.	Improved Double Detection Gas Chromato- graph-Mass Spectrometer Interface for the Analysis of Complex Organic Mixtures, W73-11663
PENNSYLVANIA DEPT. OF HEALTH, HARRISBURG. BUREAU OF SANITARY ENGINEERING.	A Study of Vapor Phase Polymerization and Crosslinking to Prepare Reverse Osmosis Mem- branes, W73-11162	ROORKEE UNIV. (INDIA).
The Need for Hydrogeologic Evaluations in a Mine Drainage Abatement Program: A Case Study, Toms Run, Clarion County, Pennsyl- vania, W73-11674	RHODE ISLAND DEPT. OF HEALTH, PROVIDENCE. DIV. OF LABS.	Enumeration and Differentiation of Water Bac- teria with Phosphorus-32, W73-11133
Hydrogeologic Considerations for Sealing Coal Mines, W73-11675	Residues of Chlorinated Hydrocarbon Pesti- cides in the Northern Quahog (Hard-Shell Clam), Mercenaria mercenaria-1968 and 1969, W73-11579	RUHR-UNIVERSITAET BOCHUM (WEST GERMANY). LEHRSTUHL FUER PFLANZENPHYSIOLOGIE.
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF BIOLOGY.	RHODE ISLAND STATEWIDE PLANNING PROGRAM, PROVIDENCE.	Influence of Soil Temperature and Moisture on Survival and Growth of Strands of Phy- matotrichum omnivorum, W73-11248
Fish and Food Organisms in Acid Mine Waters of Pennsylvania, W73-11332	Protection and Control of the Salt Water Shore Area, W73-11114	SAIN T PETERSBURG BEACH CITY ENGINEERS, FLA.
PHILCO-FORD CORP., NEWPORT BEACH, CALIF. AERONUTRONIC DIV.	RHODE ISLAND UNIV., KINGSTON.	Wet Well Woes, W73-11462
Investigation of Phase and State Relations in Complex Lipid Systems, W73-11161	GRADUATE SCHOOL OF OCEANOGRAPHY.	SASKATCHEWAN UNIV., SASKATOON. DEPT. OF CIVIL ENGINEERING.
PICATINNY ARSENAL, DOVER, N.J.	Sediments in the Atlantic Corner Seamounts: Control by Topography, Paleo-Winds, and Geochemically-Detected Modern Bottom Cur- rents, W73-11394	Polarographic Method for Nitrate and Dis- solved Oxygen Analyses, W73-11662
Quantitative Infrared Spectrophotometry of Organic Nitrate Esters, W73-11600	RICHMOND DEPT. OF PUBLIC UTILITIES, VA.	SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CALIF.
	Two-Point Copper Sulfating Program Licks/AI- gue Problem, W73-11447	Man's Role in the Major Sedimentary Cycle, W73-11382
		Nutrient Inversions in the Southeastern Tropi- cal Pacific Ocean, W73-11587

ORGANIZATIONAL INDEX

TEXAS TECH UNIV., LUBBOCK. TEXTILE RESEARCH CENTER.

SCRIPPS INSTITUTION OF OCEANOGRAPHY, SAN DIEGO, CALIF. MARINE PHYSICAL LAB.		SOUTHEASTERN CONNECTICUT REGIONAL PLANNING AGENCY, NORWICH.		TATA INST. OF FUNDAMENTAL RESEARCH, BOMBAY (INDIA).	
Mercury in the Marine Environment: Concentration in Sea Water and in a Pelagic Food Chain, W73-11300	5C	Water Supply Plan for the Southeastern Connecticut Region, Volume II, Recommended Plan. W73-11249	6B	Accretion Rates of Freshwater Manganese Deposits, W73-11088	2J
SCS ENGINEERS, LONG BEACH, CALIF.		SOUTHERN REGIONAL RESEARCH LAB., NEW ORLEANS, LA.		Manganese Nodules and Budget of Trace Substances in Oceans, W73-11384	5B
The Role of Desalting in Providing High Quality Water for Industrial Use, W73-11164	3A	Removal of Mercury from Aqueous Solutions by Nitrogen-Containing Chemically Modified Cotton, W73-11174	5D	TECHNICAL UNIV., LODZ (POLAND).	
SEVERO-VOSTOCHNOE TERRITORIALNOE GEOLOGICHESKOE UPRAVLENIE, MAGADAN (USSR).		Mass Spectrometric Identification of Some bis-2,4-Dinitrophenylhydrazones, W73-11487	5A	A Small Dimension Probe for the Determination of Ground Water Flow Direction, W73-11200	2F
Upper Permian Glaciomarine Deposits in the Kolyma River Basin (Verkhnepermskiye ledovo-morskiye otlozheniya basseyna istok r. Kolomyi), W73-11103	2J	SPERRY RAND CORP., GREAT NECK, N.Y.		TECHNICAL UNIV. OF BUDAPEST (HUNGARY).	
SHEFFIELD UNIV. (ENGLAND). DEPT. OF CIVIL AND STRUCTURAL ENGINEERING.		SPERRY SYSTEMS MANAGEMENT DIV.		Behaviour of Transition Soils Under the Effect of Water, W73-11198	2G
The Influence of Delayed Drainage on Data from Pumping Tests in Unconfined Aquifers, W73-11545	2F	System Study for Surveillance of Ocean Dumping Operations. W73-11573	5B	TECHNISCHE HOCHSCHULE, DARMSTADT (WEST GERMANY).	
SHELL DEVELOPMENT CO., HOUSTON, TEX.		SPRINGFIELD SANITARY DISTRICT, ILL.		EDUARD-ZINTL-INSTITUT.	
Oxygen—A Major Element in Drill Pipe Corrosion, W73-11453	8G	Reduction of Hydraulic Sewer Loadings by Downspout Removal, W73-11671	4A	Application of Radiochemical Methods in Environmental Research, (Anwendung Radiochemischer Methoden in der Umweltforschung), W73-11125	5A
SILESIAN UNIV., KATOWICE (POLAND). INST. OF CHEMISTRY.		SREDNEAZIATSKII NAUCHNO-ISSLEDOVATELSKII GIDROMETEOROLOGICHESKII INSTITUT, TASHKENT (USSR).		TENNESSEE UNIV., KNOXVILLE. DEPT. OF CHEMISTRY.	
Alpha-Al2O3 as an Adsorbent in Thin-Layer Chromatography, W73-11128	5A	Mathematical Methods in the Theory and Practice of Mountain Streamflow Computation and Forecasting (Matematicheskiye metody v teorii i praktike raschetov i prognozov stoka gornykh rek). W73-11406	4A	Selective Determination of Copper (II) In Aqueous Media by Enhancement of Flash-Photolytically Initiated Riboflavin Chemiluminescence, W73-11136	5A
SKIDWAY INST. OF OCEANOGRAPHY, SAVANNAH, GA.		STANFORD UNIV., CALIF. DEPT. OF CIVIL ENGINEERING.		TENNESSEE UNIV., KNOXVILLE. DEPT. OF FORESTRY.	
Arsenic, Cadmium, Copper, Mercury, and Zinc in Some Species of North Atlantic Finfish, W73-11279	5B	Toward a Philosophy of Planning: Attitudes of Federal Water Planners, W73-11073	6A	Application of Remote Sensing Techniques to Measurement of Use of Outdoor Recreation Resources, W73-11546	7B
SMITHSONIAN INSTITUTION, WASHINGTON, D.C. OCEANOGRAPHY AND LIMNOLOGY PROGRAM.		STATE UNIV. OF NEW YORK, STONY BROOK, MARINE SCIENCE RESEARCH CENTER.		TENNESSEE UNIV., KNOXVILLE. DEPT. OF ZOOLOGY AND ENTOMOLOGY.	
Smithsonian Advisory Committee Report on Studies of the Effects of Waste Disposal in the New York Bight, W73-11642	5C	Characteristics and Environmental Quality of Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York, W73-11108	2K	A New Crayfish of the Subgenus Jugicambarus from Tennessee with an Emended Definition of the Subgenus (Astacidae, Decapoda), W73-11590	5A
SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY, COOMA (AUSTRALIA).		STATE UNIV. OF NEW YORK, STONY BROOK, MARINE SCIENCES RESEARCH CENTER.		TEXAS A AND M UNIV., COLLEGE STATION.	
Sediment Records of the Snowy Mountains Region, Australia. W73-11572	2J	Survey of Water Quality and Sediments in Six North Shore Bays, Nassau and Suffolk Counties, Long Island, New York (Appendix to Technical Report No. 14), W73-11109	2K	Crop Response to Trickle and Subsurface Irrigation, W73-11513	3F
SOCIETA ITALIANA RESINE S.P.A., SASSARI (ITALY). LABORATORIO CHIMICO.		Hydrographic Study of the Shelf and Slope Waters of New York Bight, W73-11110	2E	TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF CHEMISTRY.	
Acquisition and Reduction of Gas Chromatographic Data Using a Computer, W73-11491	5A	STRABAG BAU A.G., COLOGNE (WEST GERMANY).		DDT, DDE, and Polychlorinated Biphenyls in Biota From the Gulf of Mexico and Caribbean Sea—1971, W73-11580	5B
SOIL CONSERVATION RESEARCH, DEMONSTRATION AND TRAINING CENTER, CHATRA (NEPAL).		Bituminous Blanket for Dike at Ludington Pumped Storage Project, W73-11504	8F	TEXAS EASTERN TRANSMISSION CORP., SHREVEPORT, LA.	
Investigation on Erodibility and Water Stable Aggregates of Certain Soils of Eastern Nepal, W73-11272	2J	SYRACUSE UNIV., N.Y. DEPT. OF CHEMICAL ENGINEERING AND MATERIALS SCIENCE.		Determining the Strength of Corroded Pipe, W73-11527	8G
SOUTH DAKOTA STATE UNIV., BROOKINGS.		The Growth Rate of Ice Crystals: The Properties of Carbon Dioxide Hydrate A Review of Properties of 51 Gas Hydrates, W73-11156	3A	TEXAS TECH UNIV., LUBBOCK.	
Community Improvements and Service Costs, W73-11255	3D			Watershed Research, W73-11534	2A
SOUTHEASTERN CONNECTICUT WATER AUTHORITY, NORWICH; AND THE				TEXAS TECH UNIV., LUBBOCK. TEXTILE RESEARCH CENTER.	
				Removal of Oil From Water Surfaces By Sorption on Unstructured Fibers, W73-11586	5G

ORGANIZATIONAL INDEX

TEXAS UNIV., AUSTIN. DEPT. OF ZOOLOGY.

TEXAS UNIV., AUSTIN. DEPT. OF ZOOLOGY.
Some Thermal Consequences of Environmental Manipulations of Water,
W73-11355 5C

TIPPETTS ABBETT MCCARTHY STRATTON, NEW YORK.

Mobile Area Water Transportation Study of Mobile, Baldwin and Escambia Counties, Alabama.
W73-11260 8A

TOKYO UNIV. (JAPAN). DEPT. OF URBAN AND SANITARY ENGINEERING.

A Few Coastal Pollution Problems in Japan,
W73-11376 5C

TORONTO UNIV. (ONTARIO). INST. OF ENVIRONMENTAL SCIENCES AND ENGINEERING.

Remote Sensing Evaluation of Environmental Factors Affecting the Developmental Capacity of Inland Lakes,
W73-11540 7B

TRI-AID SCIENCES, INC., ROCHESTER, N.Y. (ASSIGNEE).

Waste Water Sampler,
W73-11243 5A

TUEBINGEN UNIV. (WEST GERMANY). CHEMISCHES INSTITUT.

X-Ray Photoelectron Spectroscopy of Metals in Amino Acid Complexes and Proteins, (Rontgen-Photoelektron-Spektroskopie von Metallen in Aminosäurekomplexen und Proteinen),
W73-11121 5A

TULSA UNIV., OKLA.

Abnormal Pressures in Deep Wells of Southwestern Louisiana,
W73-11464 8E

UKRAINSKII NAUCHNO-ISSLEDOVATELSKII GIDRO-METEOROLOGICHESKII INSTITUT, KIEV (USSR).

Formation and Forecast of Components in the Hydrologic Regimen of Rivers (Formirovaniye i prognozy elementov gidrologicheskogo rezhima rek).
W73-11688 2E

Precomputation of a Spring-Flood Hydrograph Based on Hydrometeorological Data (Predvychisleniye gidrografa vesennego polovod'ya po gidrometeorologicheskim dannym),
W73-11689 2E

Investigation of the Dynamics and Calculation of the Losses of Spring Runoff in a Small River Basin (Issledovaniye dinamiki i raschet poter' vesennego stoka v malom rechnom basseyne),
W73-11690 2E

Forecasting Quarterly Inflow of Water to Dnieper River Reservoirs During the Cold Half of the Year (O prognozirovani kvarthal'nogo pritoka vody v dneprovskiye vodokhranilishcha za kholodnyu polovinu goda),
W73-11691 2H

Experiment in the Use of Digital Computers to Determine Traveltime on a Tributary Reach of A River (Opty ispol'zovaniya ET'sVM pri opredelenii vremeni doseganiya na pritochnom uchastke reki),
W73-11692 2E

Use of Digital Computers to Compute Propagation of Flood Waves Along the Cascade of Reservoirs on the Dnieper River (Primeneniye ET'sVM diya rascheta rasprostraneniya voln polovodiy po kaskadu gidrouzlov na Dnepre),
W73-11693 2E

Characteristics of Ice-Jam Formation on the Soviet Reach of The Danube (Osobennosti zatorobrazovaniya na sovetskem uchastke Dunaya),
W73-11694 2C

Forecasting Time of Formation of Complete Ice Cover in the Upper Dnieper Basin (O prognozirovani strok v nastupleniya ledostava v basseyne Verkhnego Dnepra),
W73-11695 2C

UNION CARBIDE CORP., TUXEDO, N.Y.
A Neutron Spectroscopic Study of the Diffusive Kinetics and Interactions of Water in Dense Layer Desalination Membranes,
W73-11165 3A

UNIROYAL, INC., NAUGATUCK, CONN. POLLUTION ABATEMENT CONTROL.
BOD: Determining the Necessary Dilution Technique,
W73-11661 5A

UNIROYAL LTD., GUELPH (ONTARIO). RESEARCH LABS.
Gas Chromatographic and Mass Spectrometric Studies of S-Alkyl Derivatives of N,N-Dialkyl Dithiocarbamates,
W73-11622 5A

UNIT OF COASTAL SEDIMENTATION, TAUNTON (ENGLAND).
The U.C.S. Grain-Size Comparator Disc,
W73-11395 7B

UNIVERSITY COLL., LONDON (ENGLAND).
The Estimation of the Hydrologica Impact of Urbanization: An Example of the Use of Digital Simulation in Hydrology,
W73-11259 4C

UNIVERSITY COLL. OF SWANSEA (WALES). DEPT. OF CHEMISTRY.
Recent Developments in the Analytical Application of UV Photoelectron Spectroscopy,
W73-11489 5A

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.
Economic Growth and Environmental Impact: Evaluating Alternatives,
W73-11511 6B

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG (SOUTH AFRICA). HYDROLOGICAL RESEARCH UNIT.

A Mathematical Model to Aid Management of Outflow from the Okavango Swamp, Botswana,
W73-11543 6A

UPPSALA UNIV. (SWEDEN). INST. OF ZOOPHYSIOLOGY.
Low pH Values Shown to Affect Developing Fish Eggs (Brachydanio rerio Ham.-Buch.),
W73-11651 5C

URS RESEARCH CO., SAN MATEO, CALIF.
Oil/Sorbet Harvesting System for Use on Vessels of Opportunity,
W73-11445 5G

UTAH STATE DIV. OF WILDLIFE RESOURCES, SALT LAKE CITY.

Pollution as a Result of Fish Cultural Activities,
W73-11077 5B

UTAH STATE UNIV., LOGAN. DEPT. OF WILDLIFE SCIENCE.

The Relationship of Enzyme Kinetic Heterotrophy Analysis to Other Eutrophication Indices,
W73-11432 5C

UTTAR PRADESH INST. OF AGRICULTURAL SCIENCES, KANPUR (INDIA).

Fertilizer Response to the Physical Effects of Soil Compaction,
W73-11280 3F

VANDERBILT UNIV., NASHVILLE, TENN. DEPT. OF GEOLOGY.

Physical Erosion and Denudation Rates in Cartwright Basin and Vicinity, Williamson County, Tennessee,
W73-11140 2J

VIENNA UNIV. (AUSTRIA). ANALYTISCHES INSTITUT.

Anion Exchange Separations of the Elements Extractable with Tributyl Phosphate. IV, (Anionenaustausch trennungen der Mit Tributylphosphat Extrahierbaren Elemente. IV),
W73-11122 5A

VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT.

An In Situ Evaluation of Nutrient Effects in Lakes,
W73-11070 5C

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. CENTER FOR ENVIRONMENTAL STUDIES.

Nutrient Ratio Variation in Reservoir Sediments,
W73-11591 5B

VYSOKA SKOLE CHEMICKO-TECHNOLOGICKA, PRAGUE (CZECHOSLOVAKIA). DEPT. OF WATER TECHNOLOGY.

Chemical Oxygen Demand of Some Nitrogenous Heterocyclic Compounds,
W73-11611 5A

WAPORA, INC., WASHINGTON, D.C.

State-of-the-Art Review of Pulp and Paper Waste Treatment,
W73-11080 5D

WASHINGTON STATE UNIV., PULLMAN.

Water Potentials in Nonwilted Dianthus Grown in Different Nutrient Solution Concentrations,
W73-11191 2I

WASHINGTON STATE UNIV. PULLMAN. DEPT. OF COMPUTER SCIENCE.

On Large Diversions from the Northwest-Normal and High-Flow Years,
W73-11685 6A

WASHINGTON STATE WATER RESEARCH CENTER, PULLMAN.

Analysis of Engineering Alternatives for Environmental Protection from Thermal Discharges,
W73-11078 5G

ORGANIZATIONAL INDEX

YONSEI UNIV., SEOUL (REPUBLIC OF KOREA). DEPT. OF

WASHINGTON UNIV., SEATTLE. Steam Stripping Odorous Substances from Kraft Effluent Streams (SEKOR), W73-11060	5D	WESTVACO CORP., COVINGTON, VA. CHEMICAL DIV. Activated Carbon for Palatable Water: Granular or powdered, W73-11422	5F	Adsorption of Chlorinated Hydrocarbons from Seawater by a Crosslinked Polymer, W73-11443	5A
WASHINGTON UNIV., SEATTLE. DEPT. OF ATMOSPHERIC SCIENCES. Continuous Observations of the Structural Changes in Deforming Polycrystalline Ice, W73-11556	2C	WHITING WATER WORKS, IND. Ozonation at Whiting: 26 Years Later, W73-11316	5F	Petroleum Hydrocarbons and Fatty Acids in Wastewater Effluents, W73-11575	5B
WASHINGTON UNIV., SEATTLE. DEPT. OF CIVIL ENGINEERING. Probabilistic Short-Term River Yield Forecasts, W73-11366	4A	WILMINGTON BOARD OF WATER COMMISSIONERS, DEL. How to Black Out Algae, W73-11420	5F	Improved Method for Characterizing Environmental Hydrocarbons by Gas Chromatography, W73-11607	5A
WASHINGTON UNIV., SEATTLE. DEPT. OF OCEANOGRAPHY. Preliminary Report, (RV Thomas G. Thompson Cruise 66), W73-11583	5A	WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, MADISON. Relationships Between Saturated Hydraulic Conductivity and Morphometric Data of an Argillite Horizon, W73-11211	2G	WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS. DEPT. OF CHEMISTRY. Analysis of Sea Water by Difference Chromatography. Summary of Progress 1972, W73-11584	5A
Oxygen Deficient Conditions and Nitrate Reduction in the Eastern Tropical North Pacific Ocean, W73-11589	5A	WISCONSIN STATE UNIV., PLATTEVILLE. A Flow Proportional Composite Sampler, W73-11463	5A	WORCESTER POLYTECHNIC INST., MASS. Combined Effect of Thermal and Organic Pollution on Oxygen Sag Curve, W73-11423	5C
WASHINGTON UNIV., ST. LOUIS, MO. Volatilization of Mercuric Chloride by Mercury-Resistant Plasmid-Bearing Strains of Escherichia coli, Staphylococcus aureus, and Pseudomonas aeruginosa, W73-11286	5B	WISCONSIN UNIV., GREEN BAY. COLL. OF ENVIRONMENTAL SCIENCES. Falling-Drop Technique for Silt-Clay Sediment Analysis, W73-11558	5A	WORLD HEALTH ORGANIZATION, COPENHAGEN (DENMARK). REGIONAL OFFICE FOR EUROPE. Mercury-A Case Study of Marine Pollution, W73-11375	5B
WATER RESOURCES ENGINEERS, INC., SPRINGFIELD, VA. Behavior of Groundwater Flow Subject to Time-Varying Recharge, W73-11142	2F	WISCONSIN UNIV., MADISON. DEPT. OF BOTANY; AND WISCONSIN UNIV., MADISON. INST. OF PLANT DEVELOPMENT. Plant Analysis for Nutrient Assay of Natural Waters, W73-11057	5C	WORLD WATER RESOURCES, INC., NEW YORK. (ASSIGNEE). Water Decomposition Apparatus, W73-11234	5F
WATER WORKS ENGINEERING, VOL 113, NO 4, P 554-555, APRIL 1960. Microstraining Removes Algae and Cuts Filter Back-Washing, W73-11450	5F	WISCONSIN UNIV., MADISON. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING. Circulation Patterns in Lake Superior, W73-11342	2H	WYOMING UNIV., LARAMIE. DEPT. OF ZOOLOGY AND PHYSIOLOGY. Biological Effects of Fluctuating Water Levels in the Snake River, Grand Teton National Park, Wyoming, W73-11594	2E
WATERLOO UNIV. (ONTARIO). DEPT. OF BIOLOGY. Seasonal Emergence of Some High Arctic Chironomidae (Diptera), W73-11148	2I	WISCONSIN UNIV., MADISON. DEPT. OF ENTOMOLOGY. Phenylmercuric Acetate: Metabolic Conversion by Microorganisms, W73-11187	5B	WYOMING UNIV., LARAMIE. DIV. OF AGRICULTURAL ECONOMICS. Financing Private Water Resource Development: Analysis of a State Loan Program, W73-11686	3F
WEST VIRGINIA PULP AND PAPER CO., TYRONE, PA. CHEMICAL DIV. Activated Carbon for Water Treatment, W73-11352	5F	WISCONSIN UNIV., MADISON. DEPT. OF PESTICIDE DEGRADATION BY MARINE ALGAE. W73-11601	5B	YALE UNIV., NEW HAVEN, CONN. DEPT. OF GEOLOGY AND GEOPHYSICS. Physical Models of Large Scale Ocean Circulation, W73-11368	2E
WEST VIRGINIA PULP AND PAPER CO., TYRONE, PA. TECHNICAL SERVICE LAB. STAFF. Taste and Odor Control - Chemicals and Methods, W73-11421	5F	WISCONSIN UNIV., MADISON. DEPT. OF SOIL SCIENCE. Mercury Accumulation by Myriophyllum Spicatum L., W73-11168	5C	Sulfate Reduction, Pyrite Formation, and the Oceanic Sulfur Budget, W73-11386	5B
WEST VIRGINIA UNIV., MORGANTOWN. DIV. OF PLANT SCIENCES. Ferrous Iron and the Growth of Twenty Isolates of Phytophthora Infestans in Synthetic Media, W73-11490	5A	Use of Physical Methods to Expand Soil Survey Interpretations of Soil Drainage Conditions, W73-11210	2G	YONSEI UNIV., SEOUL (REPUBLIC OF KOREA). DEPT. OF CHEMISTRY. Cation Exchange Separation of Metal Ions With Potassium Chloride-Chelating Agent-Organic Solvent Medium, W73-11311	5A
WESTERN MICHIGAN UNIV., KALAMAZOO. Coastal Dynamics along Mustang Island, Texas, W73-11081	2L	WISCONSIN UNIV., MADISON. WATER CHEMISTRY LAB. Measurement of Exchangeable Inorganic Phosphate in Lake Sediments, W73-11596	5A		
WESTFIELD COLL., LONDON (ENGLAND). A Study of a Small Tropical Lake Treated With the Molluscicide Frescon, W73-11614	5C	WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS. Chlorinated Hydrocarbons in Open-Ocean Atlantic Organisms, W73-11377	5B		

ACCESSION NUMBER INDEX

W73-11051	5C	W73-11129	5A	W73-11207	5G	W73-11285	2K
W73-11052	2L	W73-11130	5A	W73-11208	5B	W73-11286	5B
W73-11053	4B	W73-11131	5C	W73-11209	5B	W73-11287	5G
W73-11054	2C	W73-11132	5B	W73-11210	2G	W73-11288	5D
W73-11055	6F	W73-11133	5A	W73-11211	2G	W73-11289	5C
W73-11056	2B	W73-11134	5A	W73-11212	2G	W73-11290	5B
W73-11057	5C	W73-11135	5B	W73-11213	2K	W73-11291	5A
W73-11058	5D	W73-11136	5A	W73-11214	7B	W73-11292	5B
W73-11059	5D	W73-11137	5A	W73-11215	4C	W73-11293	5B
W73-11060	5D	W73-11138	5F	W73-11216	7B	W73-11294	5A
W73-11061	5A	W73-11139	4A	W73-11217	5B	W73-11295	5A
W73-11062	5G	W73-11140	2J	W73-11218	7C	W73-11296	5A
W73-11063	5G	W73-11141	2E	W73-11219	7C	W73-11297	5A
W73-11064	5G	W73-11142	2F	W73-11220	7C	W73-11298	5A
W73-11065	5D	W73-11143	2I	W73-11221	4B	W73-11299	5A
W73-11066	5D	W73-11144	5C	W73-11222	4B	W73-11300	5C
W73-11067	5A	W73-11145	3F	W73-11223	3A	W73-11301	5A
W73-11068	5D	W73-11146	6A	W73-11224	5D	W73-11302	5A
W73-11069	5D	W73-11147	5G	W73-11225	5G	W73-11303	5C
W73-11070	5C	W73-11148	2I	W73-11226	5D	W73-11304	5B
W73-11071	5G	W73-11149	3F	W73-11227	7B	W73-11305	5A
W73-11072	5C	W73-11150	5G	W73-11228	5D	W73-11306	5A
W73-11073	6A	W73-11151	6A	W73-11229	5D	W73-11307	5C
W73-11074	5C	W73-11152	3F	W73-11230	3A	W73-11308	5A
W73-11075	5C	W73-11153	3A	W73-11231	5D	W73-11309	5C
W73-11076	5C	W73-11154	3A	W73-11232	5G	W73-11310	4C
W73-11077	5B	W73-11155	3A	W73-11233	5D	W73-11311	5A
W73-11078	5G	W73-11156	3A	W73-11234	5F	W73-11312	5G
W73-11079	5D	W73-11157	3A	W73-11235	7B	W73-11313	5F
W73-11080	5D	W73-11158	3A	W73-11236	5F	W73-11314	5F
W73-11081	2L	W73-11159	3A	W73-11237	5F	W73-11315	5F
W73-11082	2J	W73-11160	3A	W73-11238	5D	W73-11316	5F
W73-11083	2J	W73-11161	3A	W73-11239	5D	W73-11317	5F
W73-11084	2K	W73-11162	3A	W73-11240	5D	W73-11318	5F
W73-11085	2K	W73-11163	3A	W73-11241	5D	W73-11319	5D
W73-11086	2J	W73-11164	3A	W73-11242	5D	W73-11320	5D
W73-11087	2B	W73-11165	3A	W73-11243	5A	W73-11321	4B
W73-11088	2J	W73-11166	1B	W73-11244	5G	W73-11322	5C
W73-11089	8B	W73-11167	3A	W73-11245	6D	W73-11323	5C
W73-11090	2E	W73-11168	5C	W73-11246	3D	W73-11324	5B
W73-11091	8B	W73-11169	5C	W73-11247	6E	W73-11325	5B
W73-11092	8B	W73-11170	5G	W73-11248	3F	W73-11326	5B
W73-11093	4B	W73-11171	5C	W73-11249	6B	W73-11327	5C
W73-11094	4B	W73-11172	2I	W73-11250	5E	W73-11328	5D
W73-11095	2C	W73-11173	4A	W73-11251	3D	W73-11329	5D
W73-11096	2C	W73-11174	5D	W73-11252	5G	W73-11330	5D
W73-11097	2C	W73-11175	5A	W73-11253	5G	W73-11331	5C
W73-11098	2E	W73-11176	6B	W73-11254	4C	W73-11332	5C
W73-11099	2E	W73-11177	2G	W73-11255	3D	W73-11333	5B
W73-11100	2J	W73-11178	5A	W73-11256	2G	W73-11334	5B
W73-11101	2E	W73-11179	5A	W73-11257	6B	W73-11335	5D
W73-11102	4A	W73-11180	5C	W73-11258	2G	W73-11336	5A
W73-11103	2J	W73-11181	3F	W73-11259	4C	W73-11337	5D
W73-11104	5B	W73-11182	5C	W73-11260	8A	W73-11338	5G
W73-11105	7C	W73-11183	5C	W73-11261	5D	W73-11339	5A
W73-11106	7C	W73-11184	5B	W73-11262	5D	W73-11340	5D
W73-11107	3D	W73-11185	5G	W73-11263	3D	W73-11341	6B
W73-11108	2K	W73-11186	5B	W73-11264	5G	W73-11342	2H
W73-11109	2K	W73-11187	5B	W73-11265	5C	W73-11343	2D
W73-11110	2E	W73-11188	5A	W73-11266	5D	W73-11344	2D
W73-11111	3C	W73-11189	5C	W73-11267	5C	W73-11345	2D
W73-11112	5B	W73-11190	5C	W73-11268	5B	W73-11346	2D
W73-11113	4C	W73-11191	2I	W73-11269	5B	W73-11347	2D
W73-11114	6E	W73-11192	2A	W73-11270	5B	W73-11348	2D
W73-11115	5B	W73-11193	2G	W73-11271	5C	W73-11349	2D
W73-11116	7C	W73-11194	2G	W73-11272	2J	W73-11350	2L
W73-11117	2G	W73-11195	2G	W73-11273	2G	W73-11351	5B
W73-11118	5B	W73-11196	2K	W73-11274	5B	W73-11352	5F
W73-11119	2K	W73-11197	2G	W73-11275	5B	W73-11353	5F
W73-11120	4B	W73-11198	2G	W73-11276	5E	W73-11354	2I
W73-11121	5A	W73-11199	2G	W73-11277	5B	W73-11355	5C
W73-11122	5A	W73-11200	2F	W73-11278	5B	W73-11356	3A
W73-11123	5A	W73-11201	2D	W73-11279	5B	W73-11357	5D
W73-11124	5A	W73-11202	5F	W73-11280	3F	W73-11358	3A
W73-11125	5A	W73-11203	2L	W73-11281	5D	W73-11359	5D
W73-11126	5A	W73-11204	5B	W73-11282	5A	W73-11360	5G
W73-11127	5A	W73-11205	7A	W73-11283	5D	W73-11361	5B
W73-11128	5A	W73-11206	5E	W73-11284	5B	W73-11362	5D

ACCESSION NUMBER INDEX

W73-11363

W73-11363 5G	W73-11442 5A	W73-11521 8C	W73-11600 5A
W73-11364 4A	W73-11443 5A	W73-11522 8F	W73-11601 5B
W73-11365 8B	W73-11444 5C	W73-11523 8F	W73-11602 5C
W73-11366 4A	W73-11445 5G	W73-11524 8G	W73-11603 5B
W73-11367 5B	W73-11446 5A	W73-11525 8G	W73-11604 5A
W73-11368 2E	W73-11447 5F	W73-11526 8D	W73-11605 5A
W73-11369 2B	W73-11448 5F	W73-11527 8G	W73-11606 5A
W73-11370 5B	W73-11449 5F	W73-11528 2J	W73-11607 5A
W73-11371 5B	W73-11450 5F	W73-11529 5B	W73-11608 5A
W73-11372 2K	W73-11451 5F	W73-11530 6G	W73-11609 5A
W73-11373 2K	W73-11452 4A	W73-11531 2H	W73-11610 5C
W73-11374 2K	W73-11453 8G	W73-11532 2H	W73-11611 5A
W73-11375 5B	W73-11454 8G	W73-11533 8B	W73-11612 5B
W73-11376 5C	W73-11455 8G	W73-11534 2A	W73-11613 5A
W73-11377 5B	W73-11456 8A	W73-11535 5E	W73-11614 5C
W73-11378 5B	W73-11457 8B	W73-11536 2G	W73-11615 5C
W73-11379 5B	W73-11458 8B	W73-11537 5B	W73-11616 5C
W73-11380 5C	W73-11459 8B	W73-11538 8B	W73-11617 5B
W73-11381 2A	W73-11460 8A	W73-11539 5B	W73-11618 5B
W73-11382 5B	W73-11461 8A	W73-11540 7B	W73-11619 5C
W73-11383 5B	W73-11462 8A	W73-11541 7B	W73-11620 5C
W73-11384 5B	W73-11463 5A	W73-11542 2H	W73-11621 5C
W73-11385 5B	W73-11464 8E	W73-11543 6A	W73-11622 5A
W73-11386 5B	W73-11465 8A	W73-11544 2F	W73-11623 5A
W73-11387 10C	W73-11466 8A	W73-11545 2F	W73-11624 5A
W73-11388 5B	W73-11467 8G	W73-11546 7B	W73-11625 5A
W73-11389 6G	W73-11468 8A	W73-11547 2E	W73-11626 5C
W73-11390 2G	W73-11469 4B	W73-11548 8B	W73-11627 5C
W73-11391 2K	W73-11470 8C	W73-11549 5B	W73-11628 5C
W73-11392 2L	W73-11471 5B	W73-11550 2J	W73-11629 5B
W73-11393 2J	W73-11472 8A	W73-11551 5E	W73-11630 5C
W73-11394 2J	W73-11473 8B	W73-11552 2L	W73-11631 5A
W73-11395 7B	W73-11474 8D	W73-11553 7B	W73-11632 5A
W73-11396 2E	W73-11475 8G	W73-11554 5C	W73-11633 5C
W73-11397 4B	W73-11476 8A	W73-11555 2A	W73-11634 2G
W73-11398 8E	W73-11477 8G	W73-11556 2C	W73-11635 5C
W73-11399 7C	W73-11478 8G	W73-11557 2L	W73-11636 5A
W73-11400 7B	W73-11479 8G	W73-11558 5A	W73-11637 5A
W73-11401 4A	W73-11480 8B	W73-11559 2L	W73-11638 5A
W73-11402 4C	W73-11481 8A	W73-11560 8G	W73-11639 5G
W73-11403 5A	W73-11482 5A	W73-11561 3F	W73-11640 5C
W73-11404 2E	W73-11483 5A	W73-11562 2A	W73-11641 5A
W73-11405 8I	W73-11484 5A	W73-11563 2F	W73-11642 5C
W73-11406 4A	W73-11485 5A	W73-11564 5B	W73-11643 5A
W73-11407 5C	W73-11486 5C	W73-11565 4B	W73-11644 5A
W73-11408 8B	W73-11487 5A	W73-11566 6F	W73-11645 5B
W73-11409 2J	W73-11488 5A	W73-11567 8B	W73-11646 5A
W73-11410 2K	W73-11489 5A	W73-11568 2F	W73-11647 5A
W73-11411 2J	W73-11490 5A	W73-11569 5D	W73-11648 5A
W73-11412 2F	W73-11491 5A	W73-11570 2A	W73-11649 5C
W73-11413 2K	W73-11492 5A	W73-11571 7B	W73-11650 5C
W73-11414 2A	W73-11493 5A	W73-11572 2J	W73-11651 5C
W73-11415 3F	W73-11494 5A	W73-11573 5B	W73-11652 5C
W73-11416 3F	W73-11495 5A	W73-11574 5A	W73-11653 8I
W73-11417 2G	W73-11496 3A	W73-11575 5B	W73-11654 2H
W73-11418 2G	W73-11497 4A	W73-11576 6C	W73-11655 5C
W73-11419 5F	W73-11498 8F	W73-11577 5C	W73-11656 5C
W73-11420 5F	W73-11499 8F	W73-11578 2L	W73-11657 5A
W73-11421 5F	W73-11500 6G	W73-11579 5C	W73-11658 5A
W73-11422 5F	W73-11501 8C	W73-11580 5B	W73-11659 5A
W73-11423 5C	W73-11502 2L	W73-11581 5B	W73-11660 5A
W73-11424 5D	W73-11503 8E	W73-11582 5C	W73-11661 5A
W73-11425 2L	W73-11504 8F	W73-11583 5A	W73-11662 5A
W73-11426 5D	W73-11505 3B	W73-11584 5A	W73-11663 5A
W73-11427 5B	W73-11506 8C	W73-11585 5D	W73-11664 5A
W73-11428 5B	W73-11507 3F	W73-11586 5G	W73-11665 5F
W73-11429 2I	W73-11508 8C	W73-11587 2L	W73-11666 5F
W73-11430 4B	W73-11509 3F	W73-11588 5C	W73-11667 5F
W73-11431 4A	W73-11510 6B	W73-11589 5A	W73-11668 4A
W73-11432 5C	W73-11511 6B	W73-11590 5A	W73-11669 4A
W73-11433 5C	W73-11512 7C	W73-11591 5B	W73-11670 7B
W73-11434 5G	W73-11513 3F	W73-11592 5D	W73-11671 4A
W73-11435 5G	W73-11514 8B	W73-11593 5C	W73-11672 7A
W73-11436 5G	W73-11515 5D	W73-11594 2E	W73-11673 5G
W73-11437 5G	W73-11516 8A	W73-11595 5A	W73-11674 5G
W73-11438 5G	W73-11517 8G	W73-11596 5A	W73-11675 5G
W73-11439 5G	W73-11518 7C	W73-11597 5C	W73-11676 5F
W73-11440 5D	W73-11519 8F	W73-11598 5C	W73-11677 5F
W73-11441 5G	W73-11520 8D	W73-11599 5A	W73-11678 5D

ACCESSION NUMBER INDEX

W73-11700

W73-11679 5E
W73-11680 5G
W73-11681 8H
W73-11682 8A
W73-11683 6A
W73-11684 6B
W73-11685 6A
W73-11686 3F
W73-11687 5G
W73-11688 2E
W73-11689 2E
W73-11690 2E
W73-11691 2H
W73-11692 2E
W73-11693 2E
W73-11694 2C
W73-11695 2C
W73-11696 5B
W73-11697 2J
W73-11698 4C
W73-11699 3B
W73-11700 2J

A-3

ABSTRACT SOURCES

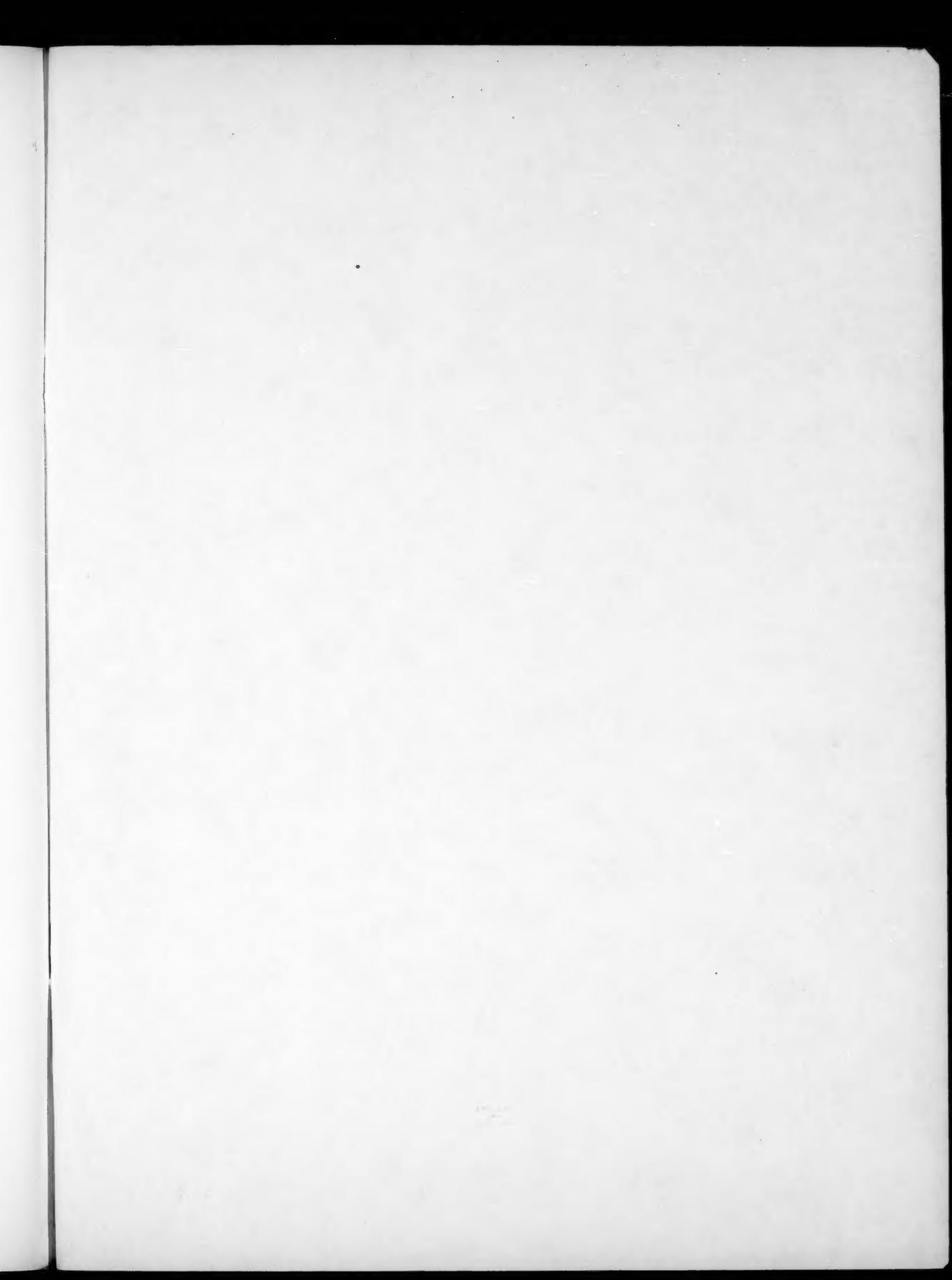
Source	Accession Number	Total
A. Centers of Competence		
American Water Works Association Research Foundation, Public Water Supply Treatment Technology	W73-11313 -- 11318 11352 -- 11353 11419 -- 11422 11447 -- 11451 11665 -- 11667	19
Battelle Memorial Institute, Methods for Chemical and Biological Identification of Pollutants	W73-11121 -- 11137 11482 -- 11495 11574 -- 11629 11631 -- 11632 11635 -- 11652 11655 -- 11664	118
Bureau of Reclamation, Engineering Works	W73-11496 -- 11501 11503 -- 11527	31
Cornell University, Policy Models for Water Resources Systems	W73-11141 -- 11142 11146 -- 11147 11149 -- 11152	20
National Water Well Association, Water Well Construction Technology	W73-11453 -- 11481	29
Oceanic Research Institute, Coastal Pollution	W73-11350 -- 11351 11376 -- 11377 11382, 11385	6
University of North Carolina, Metropolitan Water Resources Planning and Management	W73-11244 -- 11247 11249 -- 11255 11257 11259 -- 11263	17
U. S. Geological Survey, Hydrology	W73-11056 11081 -- 11110 11112 -- 11120 11193 -- 11200 11202 -- 11222 11367 -- 11375 11378 -- 11381 11383 -- 11384 11386 -- 11404 11406 -- 11414 11430 11528 -- 11551 11553 -- 11560 11562 -- 11568 11570 -- 11573 11688 -- 11700	169
Vanderbilt University, Metals Pollution	W73-11168 -- 11169 11171, 11174 11178 -- 11180 11183 -- 11185 11187 -- 11190 11265 -- 11271 11274 -- 11279 11281 -- 11283 11285 -- 11309 11311	56

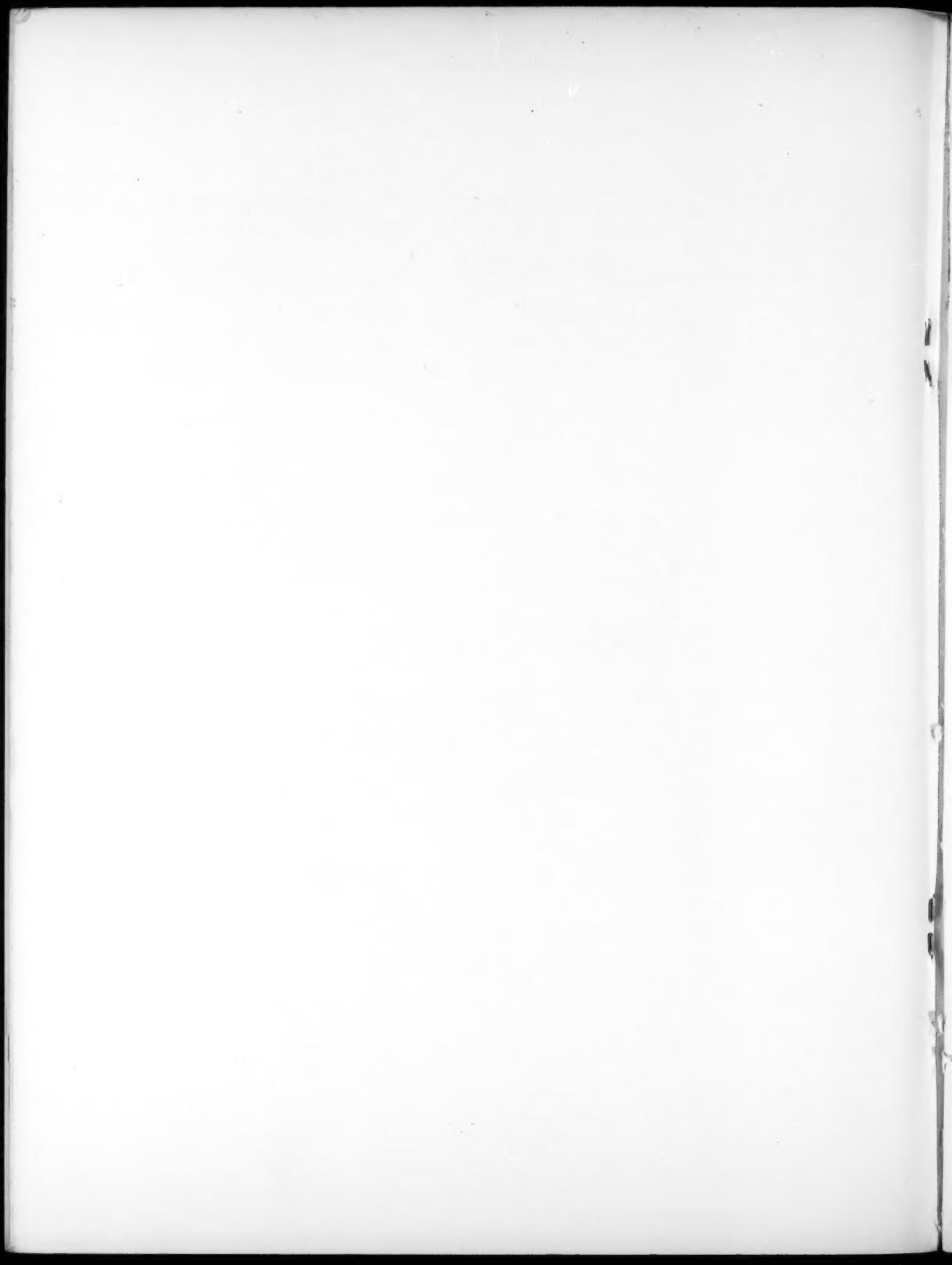
ABSTRACT SOURCES

Source	Accession Number	Total
B. State Water Resources Research Institutes		
California Water Resources Center	W73-11424	1
Delaware Water Resources Center	W73-11138	1
Georgia Environmental Resources Center	W73-11425	1
Hawaii Water Resources Research Center	W73-11052	1
Indiana Water Resources Research Center	W73-11139, 11192	2
Kansas Water Resources Research Institute	W73-11053	1
Michigan Institute of Water Research	W73-11054 11426 - 11428	4
Minnesota Water Resources Research Center	W73-11055	1
Montana Water Resources Research Center	W73-11429	1
North Carolina Water Resources Research Institute	W73-11431	1
Tennessee Water Resources Research Center	W73-11140	1
Utah Center for Water Resources Research	W73-11432	1
Wisconsin Water Resources Center	W73-11342	1
C. Other		
BioSciences Information Service	W73-11111, 11143 - 11145 11148, 11170 11172 - 11173 11175 - 11177 11181 - 11182 11186, 11191 11201, 11248 11256, 11258 11272 - 11273 11280, 11284 11310, 11312 11354 - 11355 11405 11415 - 11418 11452, 11502 11552, 11561 11569, 11630 11633 - 11634 11653 - 11654	42
Engineering Aspects of Urban Water Resources (Poertner)	W73-11668 -- 11682	15
Environmental Protection Agency	W73-11057 - 11080 11322 - 11340 11343 - 11349 11433 - 11446	64

ABSTRACT SOURCES

Source	Accession Number	Total
C. Other (cont'd)		
Ocean Engineering Information Service	W73-11223 -- 11243 11356 -- 11359	25
Office of Saline Water	W73-11153 -- 11167	15
Office of Water Resources Research	W73-11051, 11264 11319 -- 11321 11341, 11423	7





CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the Soap and Detergent Association and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Public water supply treatment technology at the American Water Works Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association.
- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.

Subject Fields

- 1 NATURE OF WATER
- 2 WATER CYCLE
- 3 WATER SUPPLY AUGMENTATION AND CONSERVATION
- 4 WATER QUANTITY MANAGEMENT AND CONTROL
- 5 WATER QUALITY MANAGEMENT AND PROTECTION
- 6 WATER RESOURCES PLANNING
- 7 RESOURCES DATA
- 8 ENGINEERING WORKS
- 9 MANPOWER, GRANTS, AND FACILITIES
- 10 SCIENTIFIC AND TECHNICAL INFORMATION



POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM 211



001

X740531
SWRA
PACIFIC POWER AND LIGHT CO
W.L. HUTCHINSON LIBRN
PUBLIC SERVICE BLDG
PURCHASE ORDER NO 4111
PORTLAND OR 97204

INDEXES

- SUBJECT INDEX
- AUTHOR INDEX
- ORGANIZATIONAL INDEX
- ACCESSION NUMBER INDEX
- ABSTRACT SOURCES

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
Springfield, Va. 22161

OFFICIAL BUSINESS

PRINTED MATTER

ORGANIC UNDER NO "111
PORTLAND OR 97204